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HARTCROWSER

Earth and Environmental Technologies

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J-4267

August 3, 1995

Mr. Ching-Pi Wang, P.E.
Toxics Cleanup Program
Washington Department of Ecology
Northwest Regional Office
3190 - 160th Avenue S.E.
Bellevue, Washington 98008-5452

Re: Request for Initial Review of
Proposed RI/FS for Independent Cleanup Reichhold/Lone Star Site
5900 West Marginal Way,
Seattle, Washington

Dear Ching-Pi:

Following up on our phone conversation today, and on behalf of Reichhold Chemicals, Inc., I am providing all available site characterization data and a brief outline of a Remedial Investigation/Feasibility Study (RI/FS) of the Reichhold/Lone Star Site located at 5900 West Marginal Way, Seattle, Washington. Reichhold would like to work with the current property owner (Lone Star Northwest) in the hope of performing an RI/FS and subsequent site remediation as an independent action under the Model Toxics Control Act (MTCA) Cleanup Regulation. To facilitate this process, we are requesting Ecology's initial comments relating to three (3) issues: 1) the appropriate general scope of RI activities to complete the site characterization; 2) prospective remedial action alternatives to be evaluated in the FS and associated RI data collection requirements; and 3) the possible need for alternate administrative procedures (e.g., Agreed Orders) during the study and/or cleanup phases of the project. We understand that Ecology will be providing initial comments on these issues during a meeting at your offices scheduled for August 10, 1995.

This letter includes a brief summary of the site history, soil and groundwater quality conditions, recent seep sampling results, preliminary comparisons with MTCA cleanup levels, and a preliminary outline of an RI work plan. Copies of the various site characterization reports are also attached to this letter.

Site History

For fifty years, a number of businesses and governmental entities have engaged in industrial activities at the site. The chronology of site ownership, development, and possible waste handling at the site is briefly summarized as follows:

- **Pre-1943.** Site largely undeveloped and apparently used for some time for lumber operations; King County owned the property from 1930 to 1943 as a result of an earlier tax foreclosing proceeding; Duwamish River dredge fill materials reported to be placed on site in approximately 1940.

- **1943-47.** Ownership by U.S. Army; operation of charcoal filter production plant; use of silver and possibly arsenic in manufacturing operations.

- **1947-60.** Lease by U.S. Army to Reichhold Chemical, Inc.; production of resins; short-term production of pentachlorophenol; impoundment (ca. 0.3 acre) in east-central portion of site constructed 1955-56 for storage and treatment of liquid wastes, and graded shortly thereafter (prior to 1960).

- **1960-64.** Ownership by U.S. Army; plant apparently inactive.

- **1964-69.** Ownership by Port of Seattle and lease to Kaiser Cement Company; demolition of former plant and construction of cement terminal and dock.

- **1969-87.** Ownership by Kaiser Cement Company; continued use as cement terminal; pit (ca. 0.3 acre) in southeast portion of site evident in 1974 aerial photograph, apparently used for disposal of waste concrete slurries; approximately 5 acre fill and/or re-grading area in south and southwest portions of the site evident in 1984 aerial photograph.

- **1987-95.** Ownership by Lone Star Northwest, Inc.; continued use as a cement terminal; area (ca. 0.2 acre) in southwest portion of site reportedly used in late 1980s for disposal of waste concrete slurries; cured waste concrete apparently stored on

southern portion of site; gravel/rock surface fill placed on south and southwest portions of site prior to 1990.

Soil and Groundwater Conditions

A considerable amount of previous soil boring data are available to characterize soil conditions at the site (Shannon and Wilson, 1964 and 1966; Hart Crowser, 1979; Parametrix, 1990). The locations of soil borings are depicted on Figure 1. Representative geologic cross sections of the site are presented on Figures 2 and 3. The figures indicate that mixed sand, gravel, and sawdust fill materials are present over the top 3 to 5 feet of the site, underlain by alluvial sand and silt. The soil surface is covered with an approximate 1-foot layer of gravel and crushed rock, and is largely unpaved. A perched groundwater unit is present seasonally at the site at depths ranging from approximately 4 to 13 feet below ground surface. The shallow perched unit forms above an organic silt and clay aquitard which is present throughout the site beginning at a depth of approximately 8 to 13 feet below ground surface. Seasonally, perched groundwater discharges to the Duwamish River through intertidal seeps.

Water-bearing alluvial sands are present below the silt and clay aquitard. Based on regional data (Liesch et al., 1963; Luzier, 1969; Sweet Edwards, 1985; Hart Crowser, 1991; South King County Groundwater Advisory Committee, 1991), groundwater in this deeper sand unit generally discharges in a northeasterly direction to the Duwamish River. Upward gradients have also been reported in the site vicinity between deeper water-bearing zones and the shallow groundwater flow system. This deeper groundwater system is not an existing or planned future source of water supply within the Duwamish Corridor area. In addition, based on the available regional hydrogeologic data, it is unlikely that groundwater at the site will be transported to other water-bearing strata that could serve as drinking water sources.

Soil samples have been collected by Parametrix (1985 and 1990) at depths ranging from 0 to 8 feet below ground surface, generally within the surficial fill unit. The soil sampling has been directed to historical areas of waste handling and/or disposal, and particularly to the former impoundment and waste pit areas of the site (Figure 1). Initial (1985) soil samples were analyzed for most of the contaminants on EPA's list of priority pollutants. Subsequent (1990) samples focused on a target analyte list including metals and total petroleum hydrocarbons (TPH). The results of soil sampling are presented in the attached Parametrix reports.

The maximum concentration of individual analytes detected in the soil samples were initially compared with MTCA Method A and B soil cleanup levels for a conservative residential use scenario. Based on this initial screening, arsenic (to 150 milligrams per kilogram; mg/kg) and total petroleum hydrocarbons (to 10,000 mg/kg) were the only chemicals identified as contaminants of potential concern in site soils. However, the Reichhold/Lone Star site meets the MTCA requirements for industrial site classification. Since the maximum soil concentrations were below MTCA industrial soil cleanup levels (e.g., 200 mg/kg Method A arsenic cleanup level), site soils do not appear to require cleanup based on direct contact exposure considerations.

Leachable (TCLP) arsenic concentrations in soils collected from the site ranged up to 600 micrograms per liter (μg/L), and may be a potential source to the underlying groundwater. Arsenic was also identified as a groundwater contaminant of potential concern based on monitoring well sampling data (see below). Although silver and pentachlorophenol were identified as groundwater chemicals of potential concern, all soil samples collected from the site contained non-detectable concentrations of these analytes. Bulk soil and TCLP concentrations of the target analytes in various areas of the site are summarized in Table 1.

Three (3) groundwater monitoring wells were installed at the site by Parametrix (1990). These wells, denoted MW-1, MW-2, and MW-3 on Figure 1, were apparently completed largely within the silt aquitard unit, as depicted on Figure 2 and 3. Water level data collected by Parametrix at the time of the late May 1990 sampling indicated that samples obtained from all three of these wells were representative only of water within the aquitard, and therefore are not representative of the primary (perched zone and deeper alluvial zone) flow pathways to the Duwamish River. No other groundwater sampling has occurred at the site, though surface water seep sampling was recently performed by Hart Crowser (see below).

The maximum concentration of individual analytes detected in the Parametrix groundwater samples were initially compared with MTCA Method A and B groundwater cleanup levels for a conservative drinking water use scenario. Based on this initial screening, six analytes were identified as contaminants of potential concern in site groundwater: arsenic (to 330 μg/L); silver (to 430 μg/L); pentachlorophenol (to 2,900 μg/L); 2,4,6-trichlorophenol (to 49 μg/L); 2,4-dichlorophenol (to 51 μg/L); and naphthalene (to 86 μg/L). However, considering the low probability that groundwater beneath the site would ever be used for or contribute to a drinking water source, MTCA cleanup levels for groundwater beneath the Reichhold/Lone Star site should reasonably be based on surface water protection and MTCA surface water cleanup levels.

Four chemicals were detected in groundwater samples collected from the Parametrix wells at concentrations which exceeded surface water cleanup levels (Table 1). The chemicals of potential concern in groundwater, as identified from this comparison, were arsenic, silver, pentachlorophenol, and 2,4,6-trichlorophenol. Dissolved silver was detected above the aquatic life criterion (1.2 μg/L) in all three wells, at concentrations ranging from 270 to 430 μg/L. Dissolved arsenic was detected above the aquatic life criterion (36 μg/L) in the two furthest downgradient wells (MW-2 and MW-3), at concentrations ranging from 150 to 330 μg/L. Finally, total (unfiltered) pentachlorophenol and 2,4,6-trichlorophenol were detected above MTCA surface water cleanup levels (4.9 and 3.9 μg/L, respectively) in the one well installed adjacent to the former Reichhold impoundment (MW-2), at concentrations of approximately 2,900 and 49 μg/L, respectively. The reported pentachlorophenol and 2,4,6-trichlorophenol concentrations at MW-2 could have been biased high because of sample turbidity. No data were available on TPH concentrations in site groundwater.

Sediment quality data are available for the Duwamish Waterway in the immediate site vicinity, and can be used to assess possible releases of these chemicals to surface water. Based on a preliminary review of these data (Tetra Tech, 1988), neither arsenic, silver, nor pentachlorophenol have been detected above existing sediment quality criteria in the immediate site vicinity, and are therefore not identified as offshore chemicals of potential concern at the site.

Analytical Results for Seep Samples

On May 15, 1995, Hart Crowser collected water samples from three (3) relatively prominent surface water seeps which were observed discharging along the shoreline adjacent to the site. All three seeps appear to reflect discharges from the perched groundwater zone (Figure 2). Sample locations (SW-01, SW-02, and SW-03) are depicted on Figure 1. Sampling corresponded to early flood tide conditions which occurred immediately after a relatively low tide event on that day. Water sampling at all three locations occurred as late as possible during the rising tide, but before inundation of the sampling location, to allow for maximum drainage of seawater from the sampling location.

may not have sufficient time to collect GW.

Prior to water sampling, field measurements of flow, temperature, pH, and salinity were performed. Subsequently, sample bottles were filled by excavating a shallow depression in the beach (predominantly silty sand with gravel), and allowing suspended sediments to flush through the depression for at least 10 minutes or until turbidity had been removed, whichever was longer. Sample bottles provided by Laucks Testing Laboratories, Inc.

(Laucks) were then carefully lowered into the depression (upstream mouth end first) and allowed to fill. Because of the relatively low flow observed at SW-03, sufficient sample volume for total petroleum hydrocarbon (TPH) analyses could not be obtained from this location prior to tidal inundation.

Seep samples were submitted to Laucks for analysis of arsenic (Method 7061), silver (Methods 200.8 and 6010), semivolatile organics (Method 8270), and TPH (Method WTPH-D; SW-01 and SW-02 only). Initial silver determinations were performed using Method 6010 analyses. Laucks re-analyzed the samples using Method 200.8 to obtain lower detection limits. A summary of analytical results is presented in Table 2.

The analytical data reveal that silver, pentachlorophenol, and TPH were not detected in any of the seep samples, and were also below ambient surface water quality criteria and MTCA cleanup levels. The total arsenic concentration detected at SW-01 (85 μg/L) was below both chronic and acute water quality criteria of 190 and 350 μg/L, respectively, as defined based on measured sample salinity in this estuarine area (see WAC 173-201A-060[2]). Similarly, the total arsenic concentration detected at SW-02 (82 μg/L) and SW-03 (30 μg/L) were also well below both the chronic and acute water quality criteria of approximately 150 and 290 μg/L, respectively.

Summary of Site Cleanup Requirements

Based on the available site characterization data summarized above, site cleanup requirements and additional data needs can be summarized as follows:

1. Site soils do not pose a direct contact hazard and contain relatively low concentrations of leachable contaminants;
2. Sources of groundwater contaminants to the site, related to historical site activities, appear to have been controlled. Additional data are required to confirm the absence of residual soil source areas at the site;
3. Several mechanisms exist at the site which may increase the mobility of the identified site contaminants, including factors which are unrelated to hazardous substance releases (e.g., the presence of sawdust in site soils, and possible oxidation-reduction mechanisms contributing to arsenic transport);
4. Groundwater within the silt aquitard beneath the site contains elevated concentrations of metals and pentachlorophenol which exceed MTCA cleanup levels. However, because of upward gradients, the deeper groundwater system is unlikely to have been affected by these releases. Again, additional data are necessary to confirm this condition;

5. Risks resulting from the existing discharge of groundwater contaminants to the Duwamish River, as determined by the initial seep sampling, appear to be minor or negligible. Additional data are necessary to verify this condition through other seasons.

Considering the available data, prospective remedial actions at the site could include further source control (e.g., if "hotspot" soils are identified by additional sampling), shallow groundwater migration controls, and possible deeper groundwater controls (in the unlikely event that significant groundwater contamination is identified below the silt aquitard unit). With respect to shallow groundwater migration controls, the presence of the continuous silt aquitard across the entire site would ensure the successful performance of a perched groundwater containment and dewatering system. An effective shallow groundwater control system for this site may include construction of an interceptor french drain along the upgradient property boundary (i.e., West Marginal Way), discharge of intercepted waters to the Duwamish River, and construction of an asphalt cap across the entire site. Because elevated silver concentrations were detected at MW-1 (see Figure 1 and Table 1), additional groundwater quality data are needed at the upgradient property boundary to ensure that perched groundwater collected by a french drain would not exceed surface water quality criteria.

Groundwater extraction (i.e., pump and treat) would be an extremely impracticable method of remediating contaminated groundwater which may be present in the silt aquitard unit. In this case, groundwater extraction wells would have to be placed on 10-foot or less centers to effectively capture contaminated groundwater within the silt. Accordingly, we would not consider this alternative during the FS. However, if significant groundwater contamination were to be detected in the deeper system, pump and treat technologies may be applicable for consideration in the FS.

Preliminary Outline of RI Work Plan

- **Sampling Objective No. 1 - Confirm the Absence of Residual Soil Source Areas at the Site.** Collect approximately 5 to 10 additional soil samples from historical waste handling areas of the site. Samples would be collected within the shallow fill unit using test pit methods. Soil samples would be analyzed for identified chemicals of potential concern, including target metals (arsenic and silver), semivolatile organics, and TPH.

MW in perched aquifer downgradient of historical waste handling areas

- **Sampling Objective No. 2 - Confirm the Absence of Significant Groundwater Contamination below the Silt Aquitard Unit.** Install one upgradient and two downgradient wells at the site, with all three wells completed in the groundwater zone immediately below the silt aquitard. The upgradient well would be located west of existing well MW-1, as close as practicable to West Marginal Way. (A shallow perched zone well would also be installed at this location to determine vertical gradients and to characterize the water quality of perched groundwater inputs to a possible french drain; see below). Samples would be collected during a minimum of two quarterly sampling events (additional groundwater sampling may be necessary if significant groundwater contamination is detected). Water samples would be analyzed for the identified chemicals of potential concern, including target metals (arsenic and silver), semivolatile organics, and TPH.

- **Sampling Objective No. 3 - Determine Vertical Gradients and Characterize the Water Quality of Perched Groundwater Inputs to a Possible French Drain.** Install one shallow upgradient well in the perched zone west of existing well MW-1, as close as practicable to West Marginal Way. Samples would be collected during a minimum of two quarterly sampling events. Water samples would be analyzed for identified chemicals of potential concern, including target metals (arsenic and silver) and TPH. Semivolatile organic analysis at this location is not necessary.

up or down gradient

- **Sampling Objective No. 4 - Confirm the Absence of Significant Surface Water Contamination in Seeps Which Discharge to the Duwamish River.** Collect seep samples from SW-01, SW-02, and SW-03 (Figure 1) for three quarters. Water samples would be analyzed for identified chemicals of potential concern, including target metals (arsenic and silver), semivolatile organics, and TPH.

Please call if you have any questions.

Sincerely,

HART CROWSER, INC.

CLAYTON R. PATMONT
Principal

cc: Mark Schneider, Perkins Coie
Alan S. Jeroue, Reichhold
John Oldham, Reichhold

Attachments:
References
Table 1 - Summary of Soil and Groundwater Quality Conditions
Table 2 - Summary of Surface Water Seep Sampling and Analysis Data
Figure 1 - Site Exploration Plan and Cross Section Location Map
Figure 2 - Generalized Subsurface Cross Section A-A'
Figure 3 - Generalized Subsurface Cross Section B-B'
Attachment A - Phase II Site Assessment by Parametrix, Inc.
Attachment B - Kaiser Property Environmental Audit, Prepared by Parametrix, Inc.

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Table 2 – Summary of Surface Water Seep Sampling and Analysis Data, 5900 West Marginal Way Site

Parameter	SW-01	SW-02	SW-03
Sampling Time	1:30 p.m.	1:40 p.m.	2:20 p.m.
Approximate Flow in gpm	2	0.5	0.05
Field Temperature in degrees C	20	19	20
Field pH in standard units	6.8	7.2	7.3
Field Salinity in ppt (a)	0.7	6.1	7.5
Total Arsenic in ug/L	85	82	30
Total Silver in ug/L	1 U	1 U	1 U
Total Pentachlorophenol in ug/L	1 U	1 U	1 U
Total WTPH-D in mg/L	0.25 U	0.25 U	No Data

NOTES:

a) Specific conductance in the nearshore Duwamish River during sampling ranged from 9.9 to 11.2 ppt.

U denotes that analyte was not detected at the indicated detection limit.

Samples collected May 15, 1995.

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Table 1 - Summary of Soil and Groundwater Quality Conditions, 5900 West Marginal Way Site, Seattle, WA

	Former Reichhold Impoundment	Former Kaiser Concrete Pit	Former Lone Star Concrete Pit	Kaiser/Lone Star Solid Concrete Handling/Disposal	Surface Water Ditch
Area in acres; (approx.)	0.3	0.3	0.2	0.5+	ca. 0.05
Average Soil Quality (0 to 8 feet)					
pH in std. units	5.3 to 5.7 (6)	6.2 to 8.2 (7)	No Data	No Data	No Data
Arsenic in mg/kg	58 (4)	57 (4)	No Data	No Data	No Data
Silver in mg/kg	2 U (4)	2 U (4)	No Data	No Data	No Data
Pentachlorophenol in mg/kg	0.1 U (3)	0.1 U (3)	No Data	No Data	No Data
Total Petroleum Hydrocarbons in mg/kg	105 (4)	65 (2)	92 (1)	No Data	10,000 (1)
Leachable Metals					
TCLP-Arsenic in ug/L	290 (1)	600 (1)	240 (1)	No Data	73 (1)
TCLP-Silver in ug/L	20 U (1)	20 U (1)	20 U (1)	No Data	20 U (1)
Groundwater Quality					
Monitoring Well	MW-2	MW-3	No Data	MW-1 (?)	No Data
Salinity in ppt (approx.)	0.5 (2)	0.2 (2)	No Data	0.9 (1)	No Data
pH in std. units	6.2 (2)	6.0 (2)	No Data	6.3 (1)	No Data
Arsenic in ug/L	150 (1)	330 (1)	No Data	5 U (1)	No Data
Silver in ug/L	430 (1)	340 (1)	No Data	270 (1)	No Data
Pentachlorophenol in ug/L	2,900 (2)	50 U (1)	No Data	50 U (1)	No Data

Note:
U = Analyte was not detected at the indicated detection limit.
(Number of samples collected within individual operation areas indicated in parentheses)

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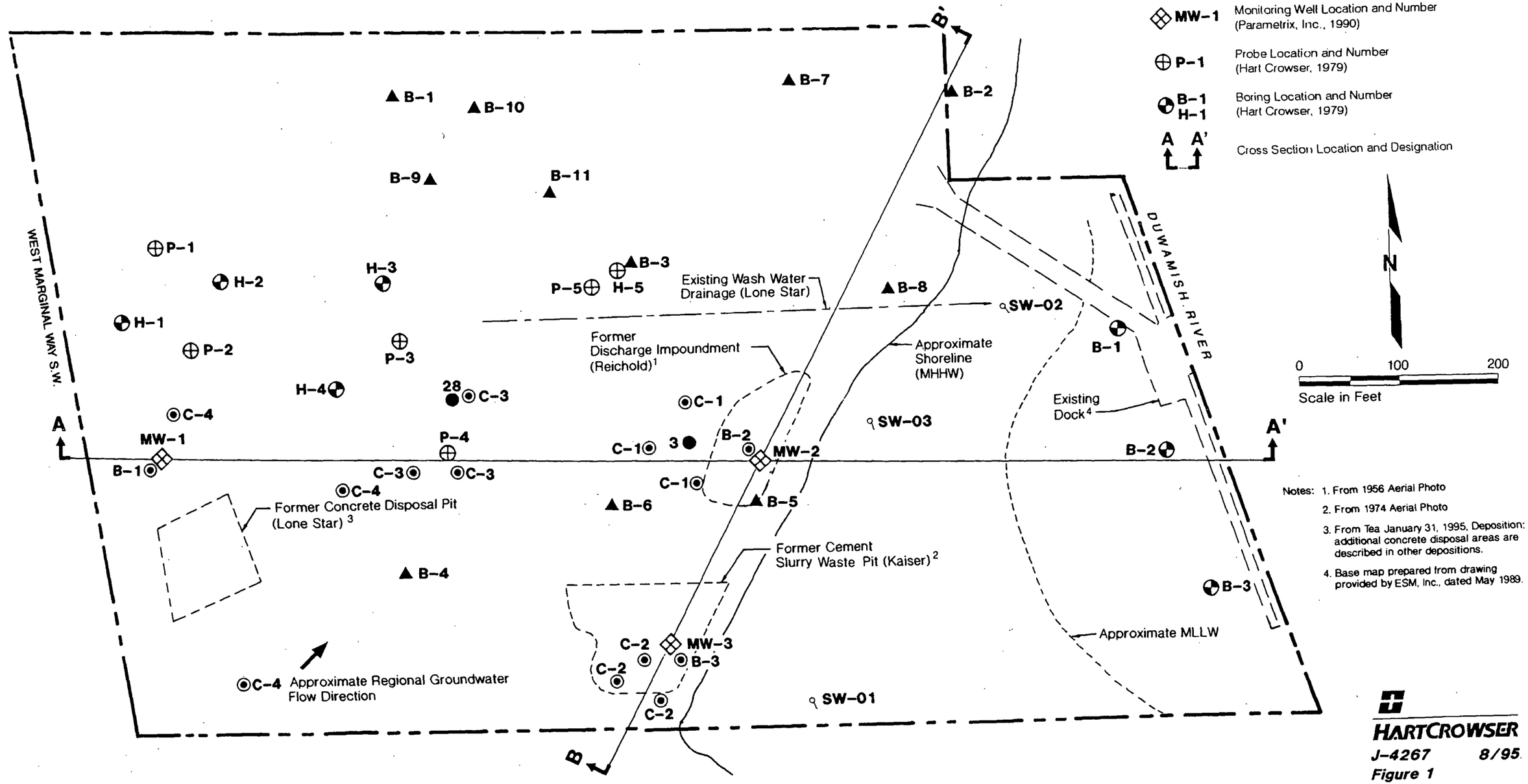
Site and Exploration Plan and Cross Section Location Map

Lone Star Northwest, 5900 West Marginal Way Property



Notes:
1. From 1956 Aerial Photo
2. From 1974 Aerial Photo
3. From Tea January 31, 1995, Deposition; additional concrete disposal areas are described in other depositions.
4. Base map prepared from drawing provided by ESM, Inc., dated May 1989.

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Figure 1

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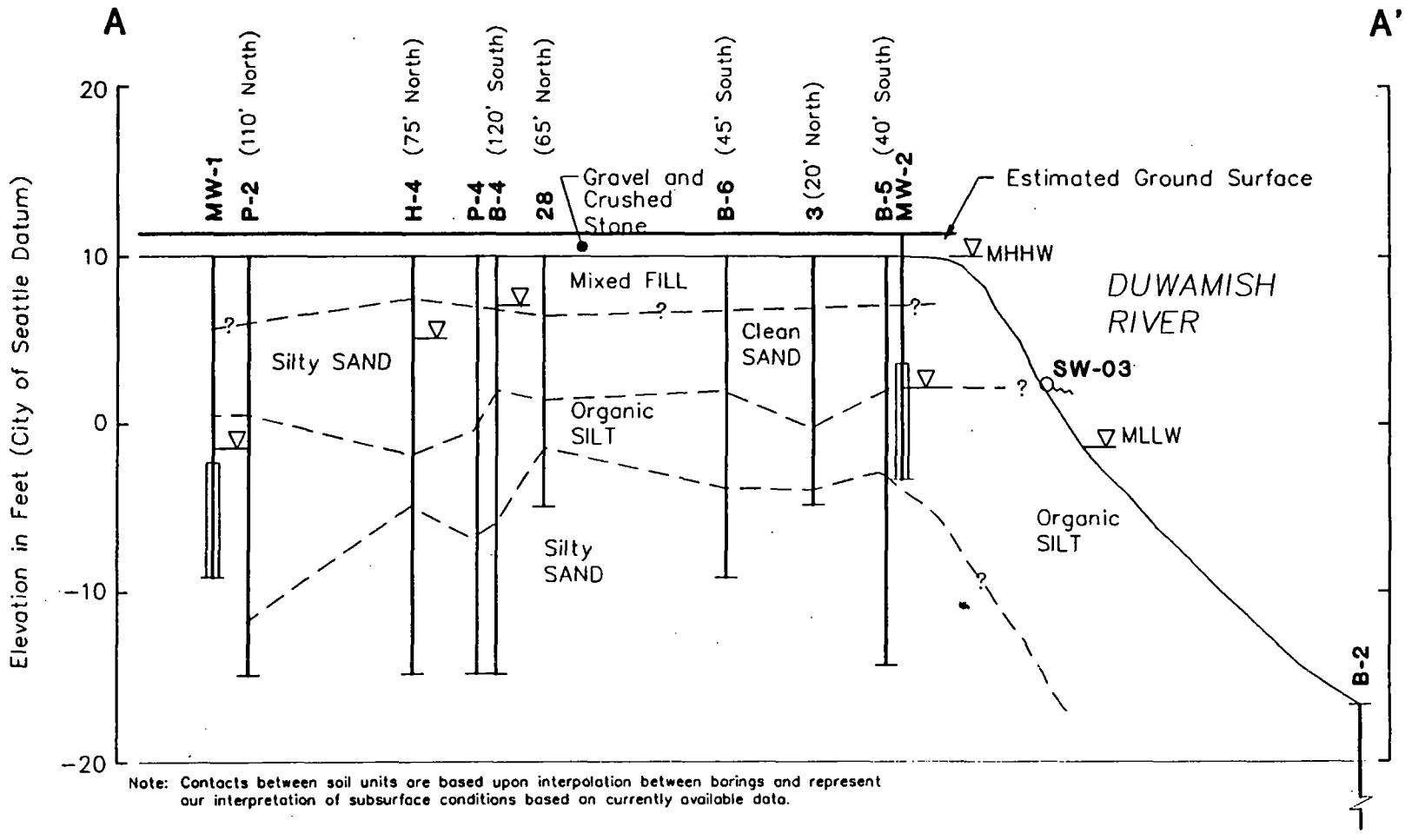
Generalized Subsurface Cross Section A-A'



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

B-5 Boring Number
MW-2 Monitoring Well Number
(40' South) Offset Distance and Direction
Exploration Location
Water Level
Screened Interval

Horizontal Scale in Feet
0 150 300
0 10 20
Vertical Scale in Feet
Vertical Exaggeration x 15

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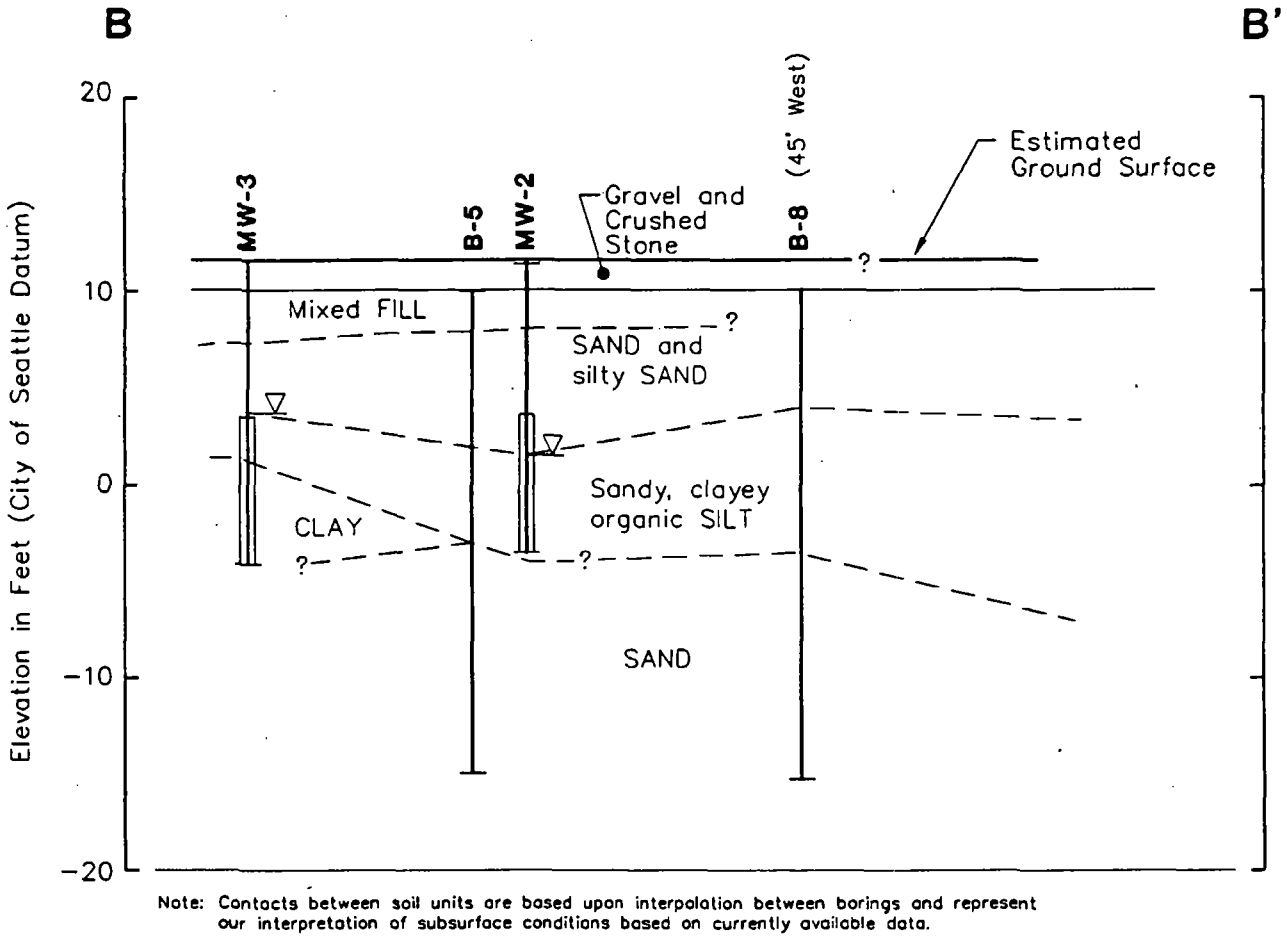
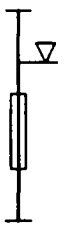
Figure 2

Generalized Subsurface Cross Section B-B'



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

B-8 Boring Number
MW-2 Monitoring Well Number
(45' West) Offset Distance and Direction



Exploration Location

Water Level

Screened Interval

Horizontal Scale in Feet
0 150 300
0 10 20
Vertical Scale in Feet
Vertical Exaggeration x 15

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Figure 3

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ATTACHMENT A
PHASE II SITE ASSESSMENT
PREPARED BY PARAMETRIX, INC.

PHASE II SITE ASSESSMENT
5900 WEST MARGINAL WAY
SEATTLE, WASHINGTON

Prepared for

LONE STAR NORTHWEST
5975 East Marginal Way South
Seattle, Washington 98111

Prepared by

PARAMETRIX, INC.
13020 Northup Way
Bellevue, Washington 98005

August 1990

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EXECUTIVE SUMMARY

This report, prepared for Lone Star Northwest, presents the results of an environmental site assessment performed at 5900 West Marginal Way in Seattle, Washington.

During the 1940s and 1950s, Reichhold Chemical, Inc. operated a manufacturing plant on the site that produced a variety of wood-preserving chemicals, including pentachlorophenol. Storage of chemical products occurred in ten cylindrical, above ground storage tanks. These tanks, each with a capacity of 20,000 gallons, were dismantled in 1969 by the Kaiser Cement Company. In the northeast corner of the property, Reichhold Chemical also utilized an unlined holding pond for the neutralization of waste hydrochloric acid.

A previous investigation was conducted in 1985 by Parametrix to assess the site for a potential property sale to the Port of Seattle. Although the historical search revealed past operations which may have contributed to site contamination, the sampling and analysis program conducted in this investigation revealed the major sources of contamination on the site appeared to be methane gas and trace metals in the soils below grade. These contaminants were described as a low risk to personnel working on the site if proper conditions were observed.

This second study, conducted during May and June, 1990 included a more comprehensive, two-phased, subsurface investigation. Results of this study, including the identification of contaminants and preliminary determination of the extent of contamination, are addressed in this report and will be used to guide any further investigations.

This second investigation included the installation of three groundwater monitoring wells and excavation of five shallow soil test pits on the property. Soil samples were collected from the well borings and test pits; and groundwater samples were collected from the wells.

Results of this investigation identified three contamination concerns: 1) pentachlorophenol in the groundwater near the former acid neutralization pond; 2) arsenic and silver in the groundwater and arsenic in the soils in the eastern portion of the site; and 3) total petroleum hydrocarbons in surficial soils in several isolated locations on site.

Parametrix recommends expanding the subsurface investigation to determine the source, and assess the extent of pentachlorophenol, arsenic, and silver contamination, so that remedial strategies can be prepared and implemented, if necessary. Furthermore, surface soils contaminated with petroleum hydrocarbons should be identified, removed, and disposed of.

1. INTRODUCTION

This report discusses the results of a two-phased site assessment conducted by Parametrix at the Lone Star property located at 5900 West Marginal Way South in Seattle, Washington.

Parametrix performed this work under contract to Lone Star Northwest to assess the subject property. This assessment was made to document the condition of the site prior to the lease of the property to a new tenant.

The first phase represented the initial site assessment and included the following:

- Review of available site information;
- Review of the process and discharge information;
- A detailed site inspection documenting current site conditions; and
- Preparation of a report documenting the findings of the first phase and development of a sampling plan.

The second phase of the site assessment included a field investigation involving collection of soil and groundwater samples to identify potential contamination on-site. Phase 2 included the following:

- Excavation of five shallow test pits, and collection and analysis of soil samples from each pit;
- Drilling three borings, including collection and analysis of three subsurface soil samples from each boring;
- Installation of three permanent groundwater monitoring wells in each boring; and
- Collection and analysis of groundwater samples from each well.

The second phase did not include a survey in the existing buildings for presence of asbestos containing materials.

This report details the history of the site, observations made during the site visit, the methods and results of the subsurface investigation, and our recommendations concerning this site.

2. SITE HISTORY

The property is located in an industrial section of Seattle on the west bank of the Duwamish River (Figure 1). The property has had several owners and tenants during the past 45 years, most of whom were involved in the manufacture or storage of industrial products. During World War II, the federal government operated a charcoal filter plant on the site to produce activated charcoal for gas masks.

From 1946 to 1960, the property was leased by Reichhold Chemical, Inc., whose operations included production of wood preserving resins, pentachlorophenol, and phenol formaldehyde. Chemicals were apparently stored in ten horizontally mounted, cylindrical tanks with 20,000-gallon capacities. Plant wastewater was discharged directly to the Duwamish River until 1955, when the Washington State Pollution Control Commission required the construction of temporary settling basins. Aerial photographs (taken in 1956) show an open pond in the northeast portion of the property which was reportedly used to neutralize hydrochloric acid from plant operations. Reichhold moved their operations to Tacoma in 1958, but did not dismantle their facilities on West Marginal Way.

The property was not used between 1960 and 1964. In 1964, the Port of Seattle purchased the property. The Port of Seattle had no records available concerning activities on the site from 1964 and 1969.

In 1969, the site was purchased by the Kaiser Cement Company, who operated a shipping and distribution terminal for their cement products on an adjacent property to the north. The site was used for the disposal of waste sand, gravel, and cement slurry. A disposal pit was located in the southeast portion of the property. In 1969, Kaiser dismantled the Reichhold facility.

Since 1969, tenants have included Parsons, who used the site for modular construction, Mobile Crane, and a concrete recycler.

The site is presently owned by Lone Star Northwest and is leased by a company for storage of large, mobile containers. The site was recently used for the storage of construction debris (e.g., concrete, rear, rubble, wood) and heavy equipment. Removal of construction equipment and debris occurred in June 1990, and portions of the site have recently been graded with imported fill.

The property located south of the site is leased by the MRI Corporation. MRI has conducted a metal reclamation and plating operation on their site for at least 22 years. Aerial photographs from 1969 show two evaporation/infiltration impoundments on the northern portion of MRI's property which were used for plating-waste effluent disposal. In 1984, the Washington State Department of Ecology (Ecology) conducted a Preliminary Assessment, and designated the site as a medium priority remediation facility due to contamination from heavy metals. There is a public roadway separating the Lone Star and

MRI properties.

The site is bordered on the east by the Duwamish River, to the west by West Marginal Way, and to the north by the Ash Grove Cement Company.

3. SITE VISIT

On May 1, 1990, Julie Wukelic and Jeff Neuner of Parametrix conducted an initial walk-through of the site. The purpose of this visit was to identify sources of potential contamination and possible locations for soil borings and groundwater monitoring wells.

Parametrix personnel noted that the site was used to store a wide variety of construction equipment and concrete debris. Throughout the site, there were large piles of concrete debris, large beams and logs, and metal rear. Most of these piles were on the northern and eastern portions of the property, and several piles were over 20 feet high. A rock crusher, operating along the northern border of the site, was being used to recycle concrete.

There were three large mobile cranes located in the western portion of the property. At the base of these cranes were several creosote-coated logs. There were several oil stains on the ground in the vicinity of these cranes.

Along the eastern edge of the property, there were two sheds containing 55-gallon drums and cans of paints, solvents, and lubricants. A 250-gallon empty tank was observed outside the sheds, as were several more 55-gallon drums and assorted empty containers that appeared to have formally stored lubricants and paints.

Several blackberry bushes were growing adjacent to the sheds, between the piles of debris and the Duwamish River. The bushes were at least ten feet tall and several feet deep, and were partially covering some of the debris.

Near the north entrance to the site, is a long building, built between 1969 and 1974. Behind this building is a fenced area with posted high voltage signs. A concrete pad was observed in the center of the fenced area. It is assumed that this pad was once used to support an electrical transformer. A second concrete pad that may have supported transformers was observed on the western border of the site.

Other than a few signs of oil stained soil, there were no obvious visual indications of contamination on the site. In general, the northeast portion of the site was covered with large piles of concrete rubble, and the southern half of the site was being used for the storage of construction equipment.

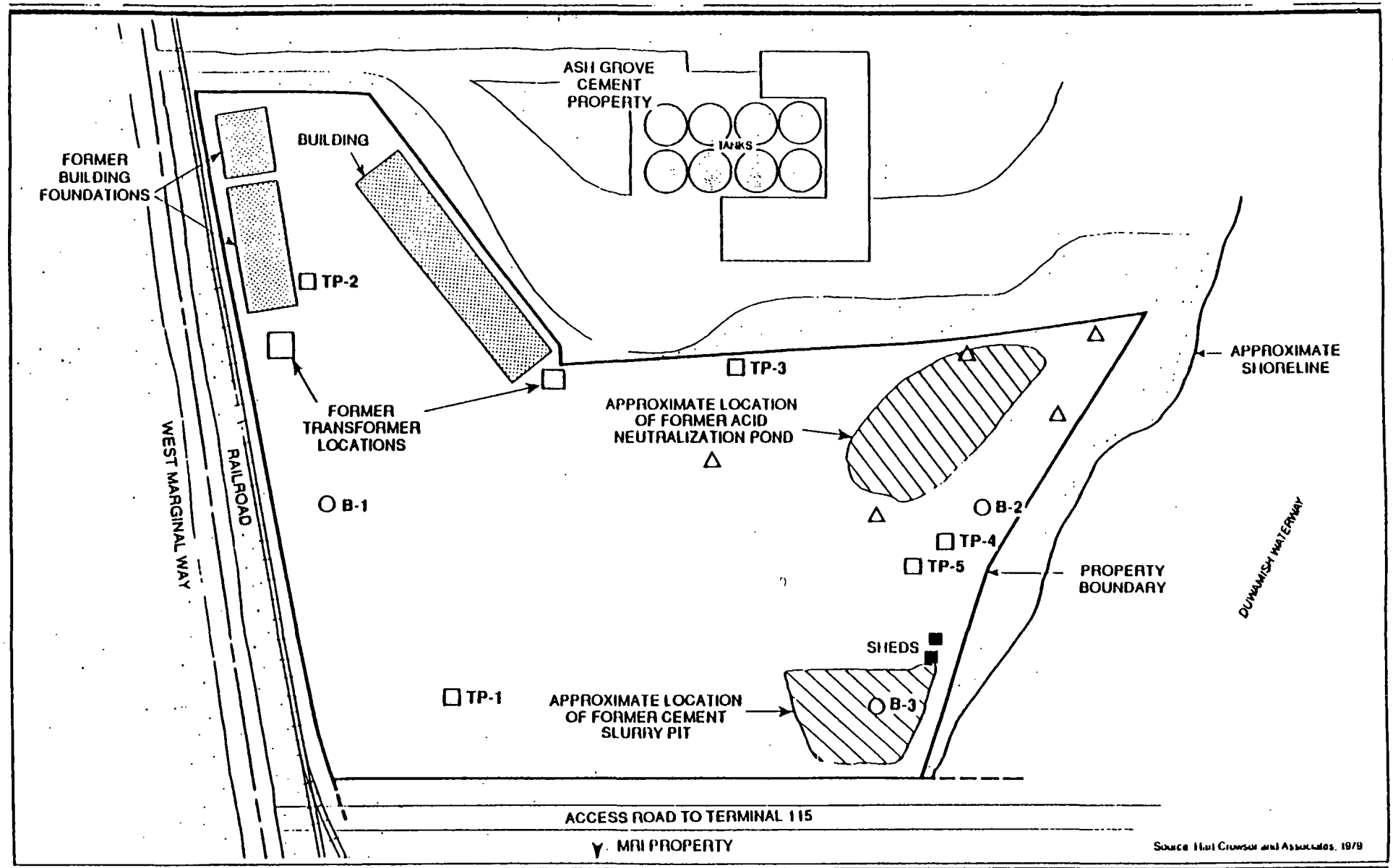

Figure 1.
Locations of monitoring wells, test pits, and proposed monitoring wells.
5900 West Marginal Way, Seattle, Washington

100277

4. SUBSURFACE INVESTIGATION

On May 17, 1990, Parametrix began a subsurface investigation of the site. The purpose of this investigation was to assess the condition of the subsurface soils and underlying groundwater, and to determine the possible hydraulic gradient. Three groundwater monitoring wells were installed, two on the eastern portion of the property and one at the western edge. In addition, five test pits were excavated with shovels to a depth of 1.5 feet. Locations of the wells and test pits are shown on Figure 1.

Groundwater monitoring wells were drilled with a 4-inch hollow stem auger. During the drilling of the groundwater monitoring wells, three soil samples were collected from each boring. Soil samples were collected at depths of 4 and 8 feet, and a composite soil sample of the entire boring also was collected. Each sample collected from the 4 and 8 feet depths was analyzed for total petroleum hydrocarbons (TPH) and total organic halogens (TOX). The composite samples were analyzed for total metals and TCLP metals. The TCLP (Toxicity Characteristic Leaching Procedure) method of analysis indicates the potential for a given contaminant (in this case, metals) to leach out of the soil.

Following borehole drilling, groundwater wells were installed. Each groundwater monitoring well was constructed of 2-inch diameter, Schedule 40 PVC. Five-foot, slotted PVC screens were placed at the bottom of the borehole and surrounded by a sand pack, allowing groundwater free entry into the well. (All groundwater monitoring well information is documented on the Well Installation Logs in Appendix A.)

Once the groundwater wells had been properly developed, one groundwater sample was collected from each well with a stainless steel bailer. Each sample was analyzed for volatile organic compounds, semi-volatile compounds, and dissolved metals. Specific conductivity and pH were measured in the field by Parametrix personnel. Additional groundwater samples were collected from Wells B-2 and B-3 two weeks after the initial groundwater sampling event and analyzed for pentachlorophenol.

Five test pits were excavated to 1.5 foot depths with a shovel. One soil sample was collected from the bottom of each test pit. Samples collected in test pits TP-1, TP-2, and TP-3 were analyzed for TPH, TOX, and TCLP metals. Samples collected from test pits TP-4 and TP-5 were analyzed for TPH and TOX.

Soil samples were collected on May 17, 1990; and groundwater samples were collected on May 24 and June 8, 1990. Samples and the appropriate chain-of-custody forms were delivered to Analytical Technologies, Inc. for analysis.

During groundwater sample collection, and on two occasions following sampling events, water level depth measurements were obtained. Water depths were subtracted from relative elevations of the top of PVC well casings to determine relative water level elevations.

5. ANALYTICAL RESULTS AND GROUNDWATER LEVEL EVALUATION

5.1 Soil Sampling

Results of the soil sampling analysis revealed the following:

1) None of the soil samples analyzed by TCLP for metals exceeded the limits that Ecology classifies as a dangerous waste.

2) Elevated levels of metals were detected in the soil, particularly arsenic, which could pose a possible health risk. Arsenic levels in composite samples collected from Wells B-2 and B-3 exceed the Model Toxic Control Act's proposed cleanup levels for general soils, but not for industrial soils. Whether or not the site is considered industrial is determined by Ecology.

3) Metal concentrations were highest in the soil recovered from Well B-2.

4) Elevated concentrations of TOX and TPH were detected at TP-3, in the vicinity of the former tanks. TPH concentrations exceeded 10,000 parts per million (ppm), in excess of Ecology's 200 ppm cleanup guidelines; TOX concentration was 24 ppm. The sample results from TP-2 indicated a TPH concentration of 240 ppm, however, field notes indicate there may have been some asphalt in the soil. While none of the other soil samples had TPH levels exceeding 200 ppm, they all had detectable concentrations, which is not unusual for an industrial site.

5) The native soils at the site consist primarily of fine silts and sands, remnants of riverine deposits. However, there has been significant filling of the site with imported material, especially crushed rock and gravel.

Analytical results from the soil sampling event are summarized in Table 1.

5.2 Groundwater Sampling

Groundwater sampling resulted in the following conclusions:

1) The levels of volatile organics in all wells were either low or below detection limits.

2) The levels of semivolatile compounds in Wells B-1 and B-3 were below detection limits.

3) Semivolatile compounds, specifically the chlorinated phenolic compounds, were detected in Well B-2. The levels of pentachlorophenol (PCP) exceeded Ecology's cleanup guidelines of 30 parts per billion (ppb). Groundwater samples collected from Well B-2 on May 24 and June 8, 1990 were analyzed for PCP; the results were

3,000 and 2,800 ppb, respectively.

The other phenolic compounds detected in Well B-2 were 2-chlorophenol, 2,4-dichlorophenol, naphthalene, and 2,4,6-trichlorophenol. All four compounds are associated with wood preservatives.

4) The concentrations of arsenic in Wells B-2 and B-3 (0.15 and 0.33 mg/l, respectively) exceeded the proposed cleanup levels in the Model Toxic Control Act (0.005 mg/l) and the state and federal Maximum Contaminant Levels (0.050 mg/l).

5) The levels of silver in Wells B-1, B-2, and B-3 (0.27, 0.43, and 0.34 mg/l, respectively) exceeded the Maximum Contaminant Levels of 0.050 mg/l.

6) Field measurements indicated a wide range of specific conductivity values (341-1,381 umhos) and slightly acidic pH levels (5.97-6.3).

Table 2 lists the results of compounds detected in the three groundwater monitoring wells.

5.3 Water Level Measurements

Water level measurements taken at three separate occasions revealed the following:

1) A perched water table possibly exists in the vicinity of Well B-3. Based on the information to date, it is not known why the water levels are perched near Well B-3. A former concrete slurry disposal pit, previously located in the vicinity, and the subsequent filling of this pit, may have impacted the water table.

2) Because of this potential perched water table, it is difficult to determine the hydraulic gradient (direction of groundwater flow) with the amount of data to date.

3) Groundwater elevations may vary within a daily cycle, due to the proximity of the Duwamish River, which is tidal at the site. Tidal fluctuations can affect the hydraulic gradient.

Table 1. Summary of analytical results from soil sampling.

Parameter	Sample Location													
	B-1	B-1	B-1	B-2	B-2	B-2	B-3	B-3	B-3	TP-1	TP-2	TP-3	TP-4	TP-5
DEPTH (feet)	4	8	C	4	8	C	4	8	C	1.5	1.5	1.5	1.5	1.5
TOX (mg/kg)	<4	<4	NA	<4	16	NA	4	<4	NA	<4	<4	23	<4	<4
TPH (mg/kg)	36	28	NA	51	57	NA	63	67	NA	92	240	10,000	130	180
TOTAL METALS (mg/kg)														
Arsenic	NA	NA	<0.5	NA	NA	79	NA	NA	150	NA	NA	NA	NA	NA
Barium	NA	NA	20	NA	NA	25	NA	NA	20	NA	NA	NA	NA	NA
Cadmium	NA	NA	<1	NA	NA	<1	NA	NA	<1	NA	NA	NA	NA	NA
Chromium	NA	NA	21	NA	NA	24	NA	NA	22	NA	NA	NA	NA	NA
Lead	NA	NA	<10	NA	NA	10	NA	NA	<10	NA	NA	NA	NA	NA
Mercury	NA	NA	0.26	NA	NA	0.22	NA	NA	<0.15	NA	NA	NA	NA	NA
Selenium	NA	NA	<0.5	NA	NA	<0.5	NA	NA	<0.5	NA	NA	NA	NA	NA
Silver	NA	NA	<2	NA	NA	<2	NA	NA	<2	NA	NA	NA	NA	NA
TLCP METALS (mg/l)														
Arsenic	NA	NA	0.006	NA	NA	0.29	NA	NA	0.60	0.24	0.043	0.073	NA	NA
Barium	NA	NA	0.18	NA	NA	0.09	NA	NA	<0.01	0.05	0.12	0.09	NA	NA
Cadmium	NA	NA	<0.01	NA	NA	<0.01	NA	NA	<0.01	<0.01	<0.01	0.01	NA	NA
Chromium	NA	NA	0.04	NA	NA	<0.02	NA	NA	<0.02	<0.02	<0.02	<0.02	NA	NA
Lead	NA	NA	<0.1	NA	NA	<0.01	NA	NA	<0.01	<0.1	<0.1	0.1	NA	NA
Mercury	NA	NA	<0.0005	NA	NA	<0.0005	NA	NA	<0.0005	<0.0005	<0.0005	<0.0005	NA	NA
Selenium	NA	NA	<0.005	NA	NA	<0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	NA	NA
Silver	NA	NA	<0.02	NA	NA	<0.02	NA	NA	<0.02	<0.02	<0.02	<0.02	NA	NA

NA - Not analyzed
C - Composite sample

Table 2. Summary of analytical results from groundwater sampling.

Parameter	Well Location and Sampling Date				
	Well B-1 (5/24/90)	Well B-2 (5/24/90)	Well B-3 (5/24/90)	Well B-2[1] (6/07/90)	Well B-3[1] (6/07/90)
PHYSICAL CHARACTERISICS					
pH	6.3	6.10	5.97	6.29	6.02
Specific Conductivity µhos	1,381	798	341	760	376
VOLATILE ORGANICS[2]					
Acetone		25			
Chloroform		3			
SEMI-VOLATILE ORGANICS[3] (µg/L)					
2-Chlorophenol		28			
2,4-Dichlorophenol		51			
Naphthalene		86			
2,4,6-Trichlorophenol		49			
Penthachlorophenol		3,000		2,800	
DISSOLVED METALS (mg/L)					
Antimony	<0.005	<0.005	<0.005		
Arsenic	<0.005	0.15	0.33		
Beryllium	<0.01	<0.01	<0.01		
Cadmium	0.0005	<0.0003	<0.0003		
Chromium	0.09	<0.02	<0.02		
Copper	0.04	<0.02	<0.02		
Lead	0.006	<0.005	0.005		
Mercury	<0.0005	<0.0005	<0.0005		
Nickel	<0.03	<0.03	<0.03		
Silver	0.27	0.43	0.34		
Thallium	<0.005	<0.005	<0.005		
Selenium	<0.005	<0.005	<0.005		
Zinc	0.04	<0.02	<0.02		

[1] Sample only analyzed for penthachlorophenol.
[2] No other volatile organic compounds were detected.
[3] No other semi-volatile organic compounds were detected.

6. RECOMMENDATIONS

Based on the data obtained during the subsurface investigation, there are three environmental concerns associated with the subject property. The main concern is the concentrations of pentachlorophenol found in the groundwater at Well B-2. The second concern is the elevated levels of certain metals in the groundwater samples collected from the three wells on site, particularly arsenic and silver, and the arsenic levels in the soil. The third concern is the concentration of TPH from certain sampling points.

Since the concentrations of pentachlorophenol in the groundwater samples collected and analyzed are in excess of Ecology's cleanup standards, a detailed groundwater investigation to assess the extent and source(s) of PCP contamination is recommended. This can be accomplished with the placement of four to six groundwater monitoring wells in the northeastern portion of the property. Groundwater samples should then be collected and analyzed from Well B-2 and each new monitoring well.

Arsenic concentrations in the groundwater exceed the cleanup guidelines listed in the Model Toxics Control Act, and levels of arsenic and silver exceed the Maximum Contaminant Levels listed in the Federal Drinking Water Standards developed under the authority of the Safe Drinking Water Act. Furthermore, levels of arsenic in the soil exceed cleanup levels for general soil, but not for industrial soil. It is probable that Ecology will consider this site to be of industrial nature. However, an assessment of arsenic and silver levels in the groundwater should be considered.

During installation of the proposed groundwater monitoring wells, soil samples should be obtained at varying depths and analyzed for total metals content (including copper), TCLP metals, and PCP. Groundwater samples should be analyzed for dissolved metals and PCP.

The TPH problem does not appear to be a major issue. Only two shallow soil samples were above the 200 ppm cleanup guideline. A practical approach would be to remove the surface soils from those sampling locations and any other obvious oil stained surface soils on the site and confirm the successful removal with verification soil samples.

In summary, we recommend the installation and sampling of four to six monitoring wells in the northeast corner of the property, and one along the south property line near the metal reclaiming impoundments. Soil and groundwater should be analyzed for PCP and metals. Results of the investigation will be used to prepare a remedial strategy, if necessary. Additionally, we recommend the removal of the obvious visibly oil-stained soil.

ATTACHMENT B
KAISER PROPERTY ENVIRONMENTAL AUDIT
PREPARED BY PARAMETRIX, INC.

ATTACHMENT B

Kaiser Property Environmental Audit

Port of Seattle

May 1985

Parametrix, Inc.
13020 Northup Way, Suite 8
Bellevue, Washington 98005

FINAL REPORT

KAISER PROPERTY ENVIRONMENTAL AUDIT

Parametrix Project 55-1562-04
May 21, 1985

Prepared for

The Port of Seattle
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Seattle, Washington 98111

By

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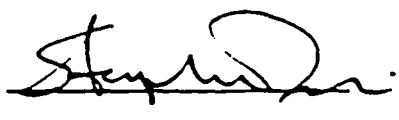
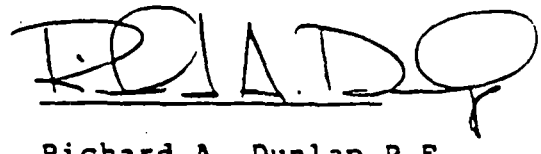


Stephen C. Perrigo
Project Manager



Richard A. Dunlap, P.E.
Principal-in-Charge

PORT OF SEATTLE - KAISER PROPERTY ENVIRONMENTAL AUDIT

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I. INTRODUCTION

This report presents a summary of Parametrix, Inc's (PMX) investigation of a parcel property known as the Kaiser Property which is under consideration for purchase by the Port of Seattle (the Port). The purpose of the investigation is to evaluate conditions related to past management of hazardous materials at the site and identify any hazards or special considerations due to such activities which may be pertinent to the Port's purchase and development of the property. Our investigation of the site has been two phased consisting of an initial site history investigation and subsequent field studies.

The initial investigation, authorized on January 3, 1985, was a site history study to identify past uses of the property which could result in health hazards or conditions that might require Port personnel or its contractors to take special precautions while visiting, working on or developing the property. On February 22, 1985 the Port authorized PMX to proceed with a field investigation of the site to obtain soil samples for laboratory analysis and to make additional observations at the site. The approach for the field investigation was confirmed in a meeting at the Port on February 27, 1985. The field investigation was performed on March 15, 1985. PMX reviewed the results of field observations with the Port and selected samples and analyses during a meeting on March 19, 1985. The results of laboratory analyses on soil samples were received by PMX on April 11, 1985.

The Kaiser Property, presently owned by Kaiser Cement Company, is located south of the existing Kaiser Cement facility at 5900 West Marginal Way, Seattle, Washington (Figure 1). The property is bordered by Kaiser cement to the north, West Marginal Way to the west, Terminal 115 to the south and the Duwamish River to the east. The property is approximately 7.6 acres in size. Presently, the site is a hard surface graveled parking area used for the storage of shipping containers. With the exception of several foundation slabs at grade, no other features due to past activity are apparent on the ground surface.

II. HISTORIC DATA

Our information on property history was obtained from conversations with Port personnel, King County files, aerial photography of the area, conversations with Kaiser Cement Company personnel, telephone conversations with other individuals familiar with the property and its past uses, review of documents pertaining to the area prepared for the Municipality of Metropolitan Seattle (METRO) and review of a geotechnical investigation of part of the property conducted by Hart-Crowser and Associates.

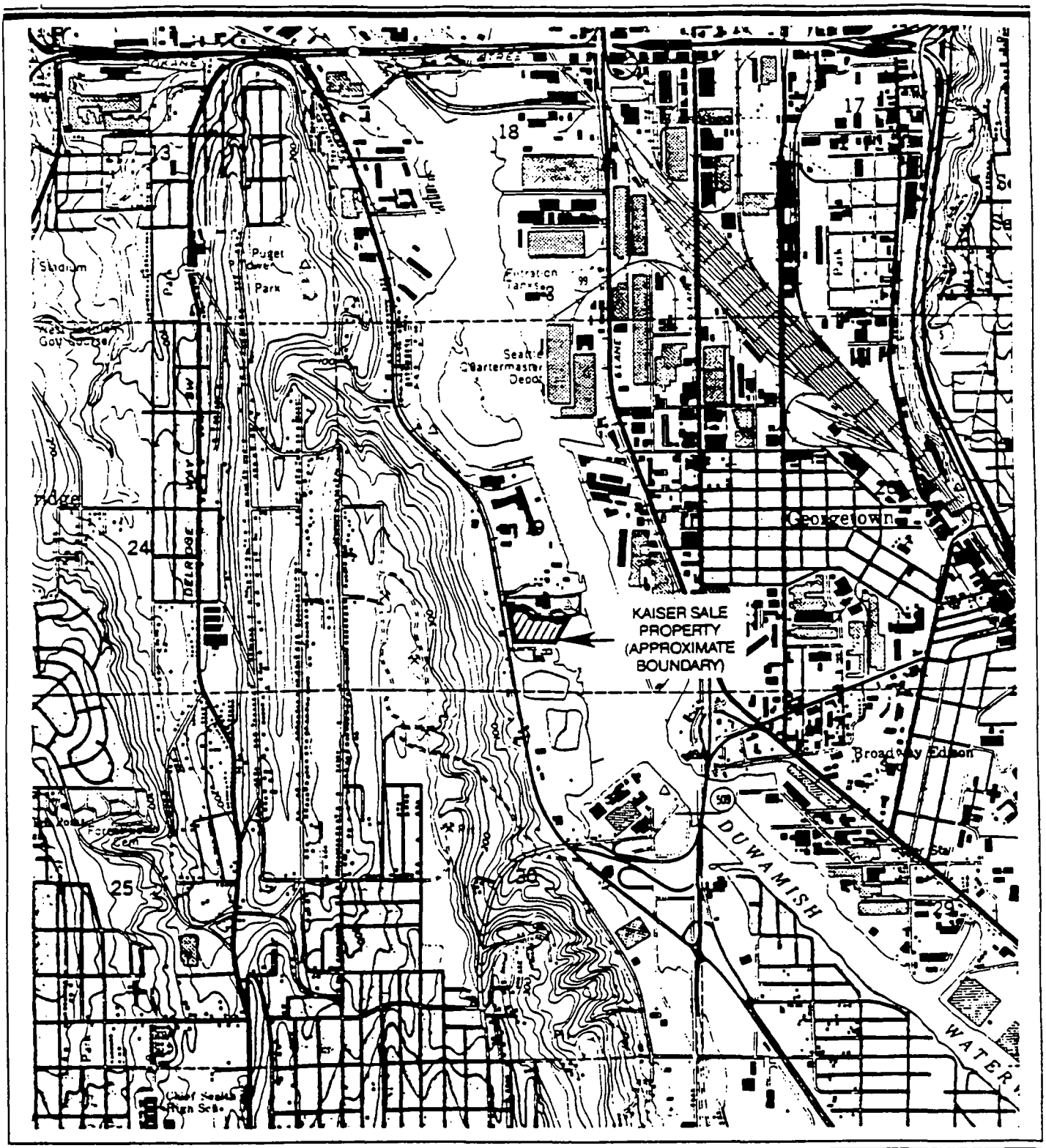

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Figure 1.
Location of Kaiser Sale Property.

The Kaiser sale property is located on the original shoreline of the Duwamish River. Dredging and filling operations, conducted in the early 1900's to create the present Duwamish Waterway, left the area of the property relatively untouched.

Aerial photography of the property and surrounding areas were examined for the years 1936, 1946, 1956, 1969 and 1974. The 1936 photo shows little development on the property or in surrounding areas. Figures 2 and 3 show aerial photographs of the property and surrounding areas for the latter four dates.

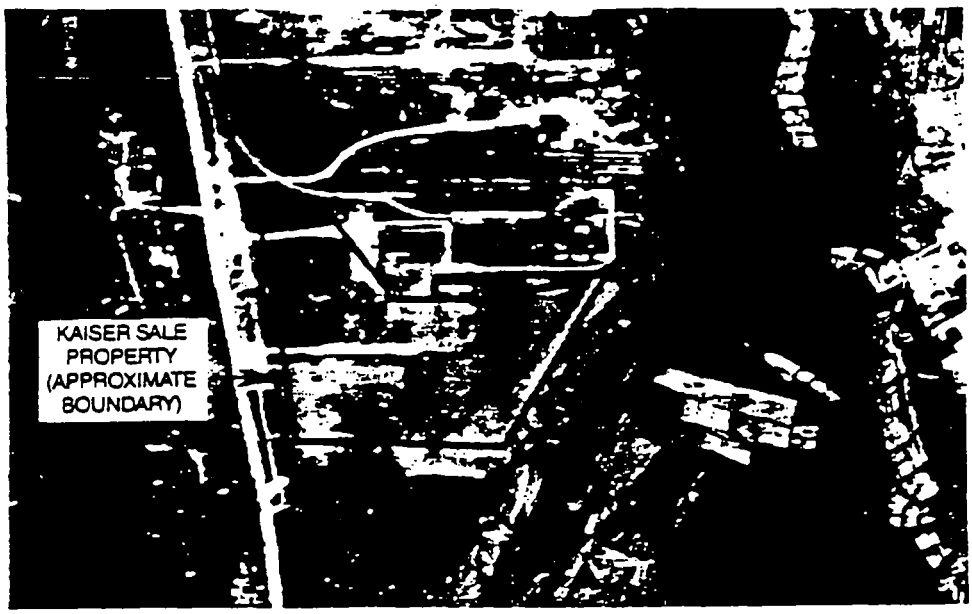
A review of the King County tax archives showed the following succession of taxpayers on the property since 1930:

1930 - 1943	King County
1943 - 1964	U.S. Federal Government
1964 - 1969	Port of Seattle
1969 - present	Kaiser Cement Company

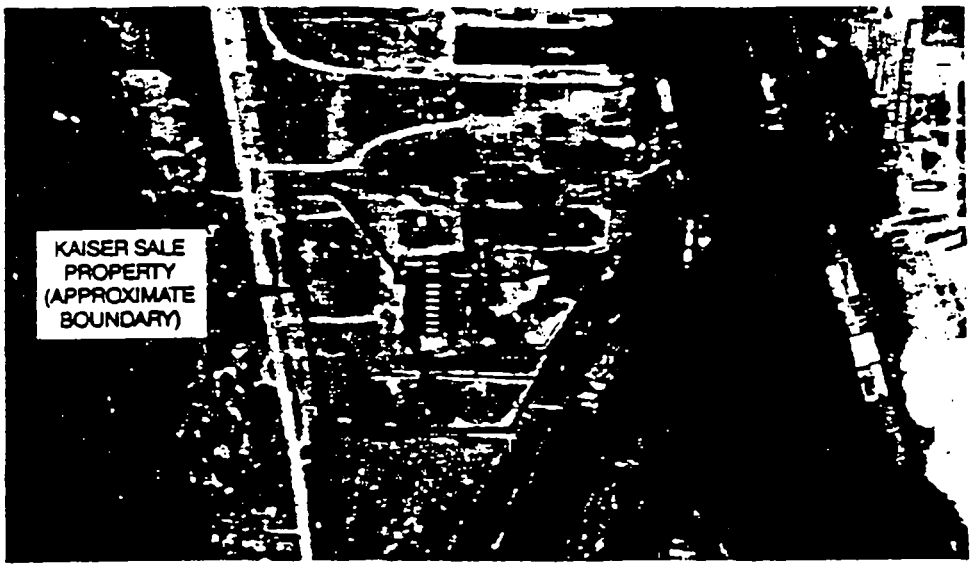
King County owned the property from 1930 to 1943. We understand that they acquired the property through a tax foreclosure proceeding. The 1936 aerial photograph does not show any visible signs of development of property at that time. We did not find any readily available information about the property prior to 1930.

King County sold the property to the Federal Government in 1943. The 1946 aerial photograph (Figure 2) shows development on the site at that time. The government operated a charcoal filter plant to produce activated charcoal for gas masks. The exact dates of plant operation are unknown, but the location of the plant buildings are apparent in the 1946 air photo. We are not aware of any specific by-products of concern from the production of activated charcoal.

In 1947, the Federal Government leased the property Reichhold Chemical, Inc. (Reichhold). Reichhold was required to maintain the government plant as part of their lease agreement, but never operated it again. The Reichhold facility produced resins and preservatives for the lumber industry. The 1956 air photo (Figure 2) shows the property development under their lease. Their primary product was phenol formaldehyde resins, but for a short period they also produced pentachlorophenol. Most of the chemicals and products were apparently stored in tanks on the property. Ten cylindrical tanks mounted horizontally are visible in the aerial photograph. Each of these tanks are about 20,000 gallons in capacity. Other tankage is also visible in the aerial photograph. The only evidence of open storage or disposal on the property is a pit or impoundment located in the northeast portion of the property (Figure 4). We understand that this pit may have been a lime pit used to neutralize waste hydrochloric acid from plant operations.



1946



1956

N

1 INCH = 500 FEET

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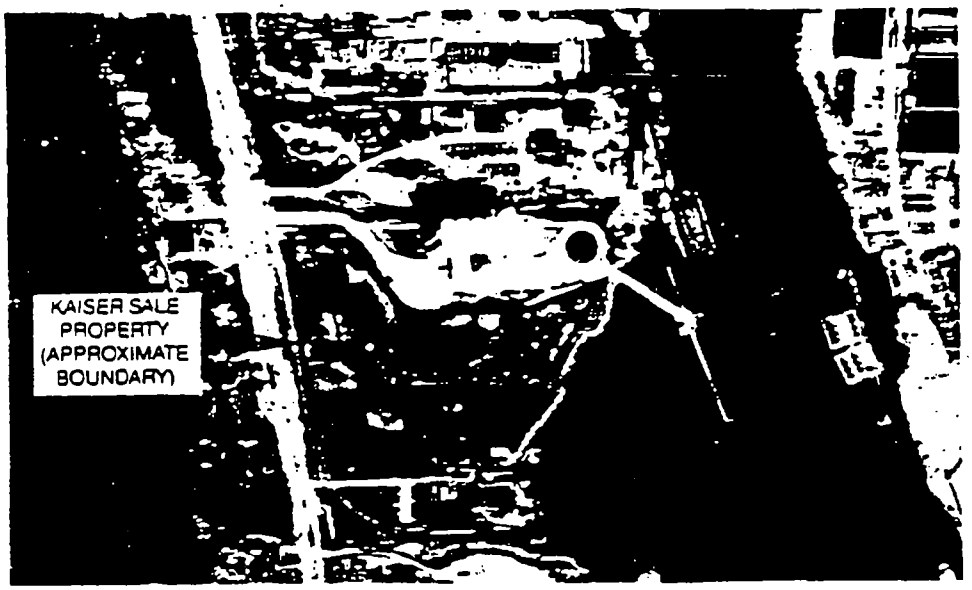
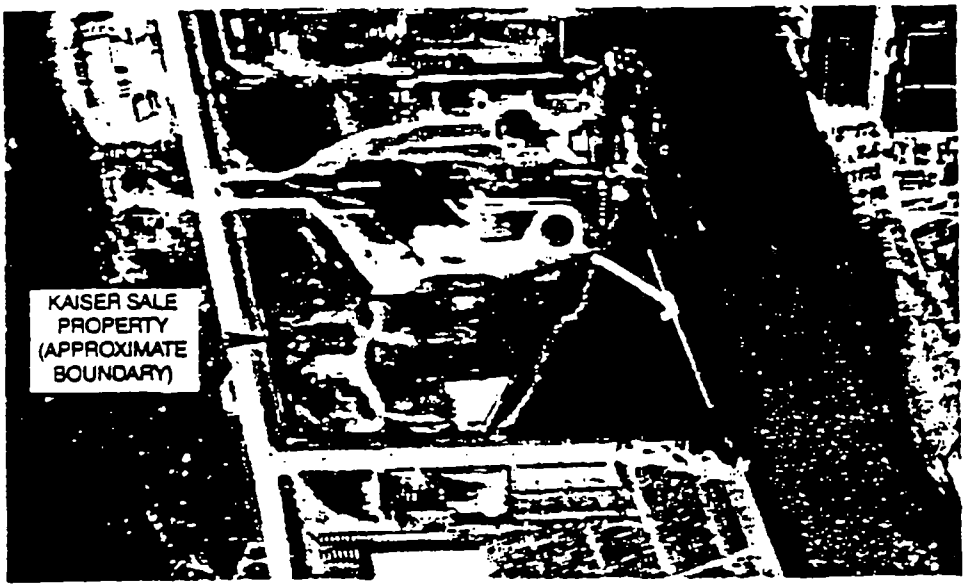
Figure 2.
Aerial photographs of Kaiser Sale Property in 1946 and 1956.



1969



1974

N

1 INCH = 500 FEET

100217

Figure 3.
Aerial photographs of Kaiser Sale Property in 1969 and 1974.

We also encountered two descriptions of past activities at the Reichhold facility. Both of the descriptions are referenced and quoted here in their entirety.

URS Engineers, 1984, Renton Effluent Transfer System, Task XVI.5 Hazardous Waste Site Survey, Preliminary Investigations, Prepared for the Municipality of Metropolitan Seattle. Pages 6-7.

"EPA records indicate that the site initially was an activated charcoal plant operated by the U.S. Army during World War II. Reichhold Chemical Company operated the site from the end of World War II to 1958, producing plastic polymers for use in the automobile industry. Raw materials handled at the site by Reichhold Chemical included soya flour, dried horse blood, and urea formaldehyde.

Three ponds were identified on the site as a result of EPA photoanalysis of the Duwamish River Valley. These ponds were observed on aerial photographs taken of the site between 1960 and 1970. Dark-stained liquid apparently being discharged from the ponds was noted in the photos. According to the file, Mr. Fred Wolfe and other EPA and state personnel visited the site during 1970. Dark-stained liquid was noted during this visit and a photograph was taken. No further information was available from EPA files.

Mr. Wolfe of EPA contacted Mr. Bob Walker, Reichhold Tacoma Plant Operations Manager, and talked with him concerning the site. Mr. Walker was a quality control chemist at the Reichhold site during its operation from 1946 to 1958. Based on review of site information and conversations with Mr. Walker, Mr. Wolfe concluded that the "waste pits" were part of a sand and gravel operation to the south of the pits and that no serious hazard existed at the time of their visit nor probably ever was present at the site due to the Reichhold operation.

Chemical analyses of water samples taken at borings D-401 and D-414 near the site have not indicated unusual levels of contaminants."

Harper-Owes, 1985, Duwamish Ground Water Studies Waste Disposal Practices and Dredge and Fill History. Draft Document. Prepared for Sweet-Edwards and Associates (For METRO). Page 12.

"The Reichhold plant manufactured synthetic resins, formaldehyde, pentachlorophenols and hydrochloric acid. Highly toxic wastewater was discharged directly into the river until the summer of 1955 when corrective action was taken by the industry in the form of temporary settling basins for the wastewater. EPA files indicate that the plant was closed in 1958.

Aerial photography taken in 1960, 1961 and 1970 show three wastewater disposal pits contained by earthen dikes at the Reichhold site. The site occupied approximately 15 acres. By 1970, a major dike had been constructed to separate the area from the river and the process of filling behind the dike had commenced. By 1974 the entire site was filled and paved over and now serves as a transshipment area."

The Reichhold plant was moved to Tacoma during the years from 1955 to 1960. It is our understanding that the Tacoma Reichhold facility manufactures a variety of chemical products to specification and has done so for a number of years.

We were not able to ascertain any activity on the property from 1960 through 1964. The Port of Seattle then bought the property from the government in 1964. The Port owned the property from 1964 to 1969, but other than their initial lease and eventual sale to Kaiser Cement Company, their use of the property is unknown. Port personnel were not able to locate records regarding their past use of the property.

Kaiser hired a contractor to demolish the old Reichhold and government buildings and has owned the property since 1969. Kaiser has used their adjacent property as a shipping and distribution terminal for cement products which were manufactured at other off-site facilities. The 1974 air photo shows a pit in the southeast corner of the sale property (Figure 5). We understand that this pit was used by Kaiser for disposal of waste sand, gravel, and cement slurries from the Kaiser facility to the north. The pit was excavated and removed by a lessee to Kaiser. Kaiser has leased the sale property primarily as a storage yard (currently the property is leased for container storage). One tenant, Parsons, built the structures in the northwest corner of the sale property (Figure 6). We understand that Parsons used the property for module construction.

Kaiser proposed to expand their facility in 1979. They contracted Hart-Crowser and Associates to perform an initial engineering and geotechnical study at that time. We reviewed the logs of borings and probes performed on the sale property to

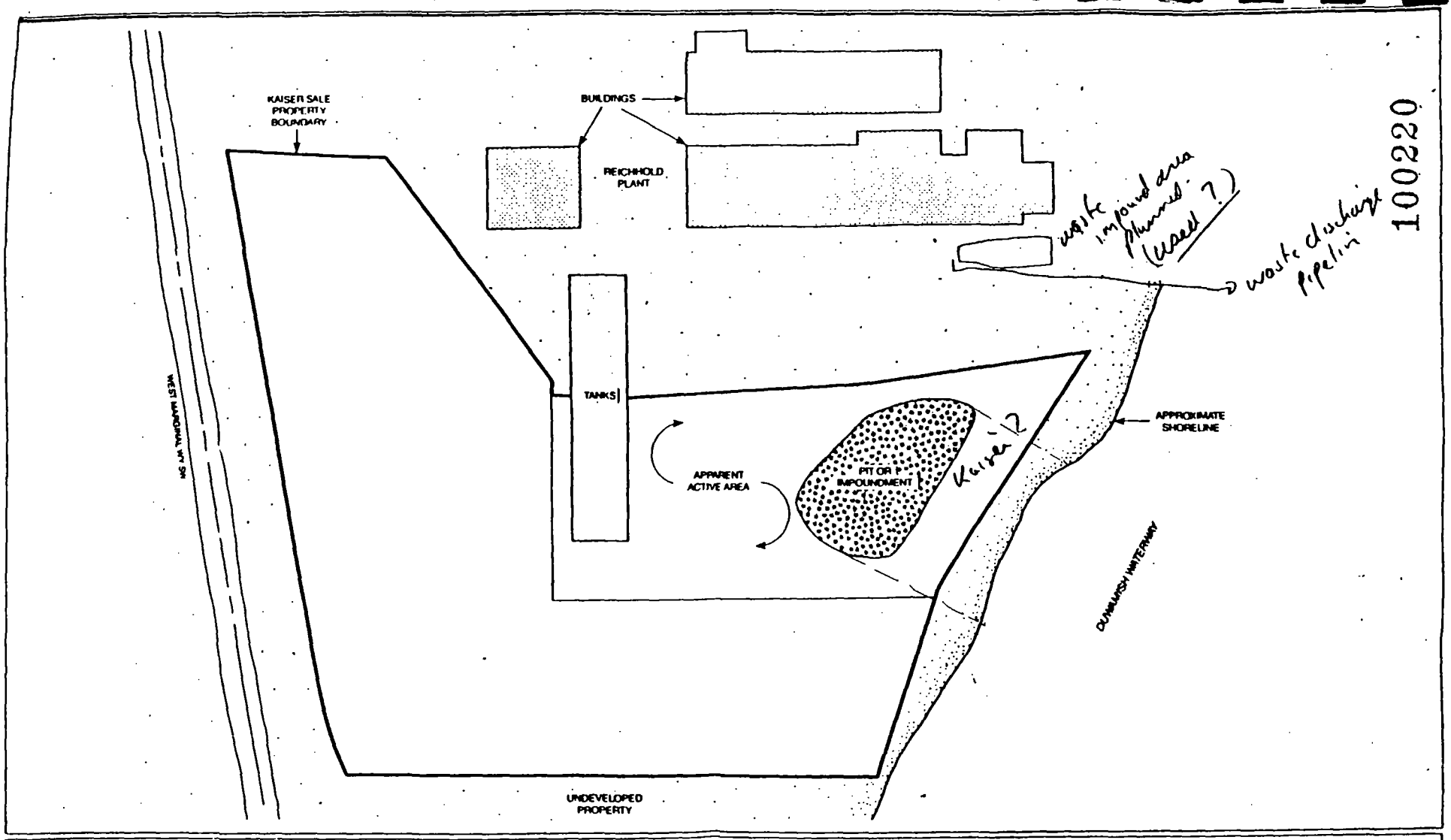


Figure 4.
Development of Kaiser Sale Property in 1956.

Parametrix, Inc.

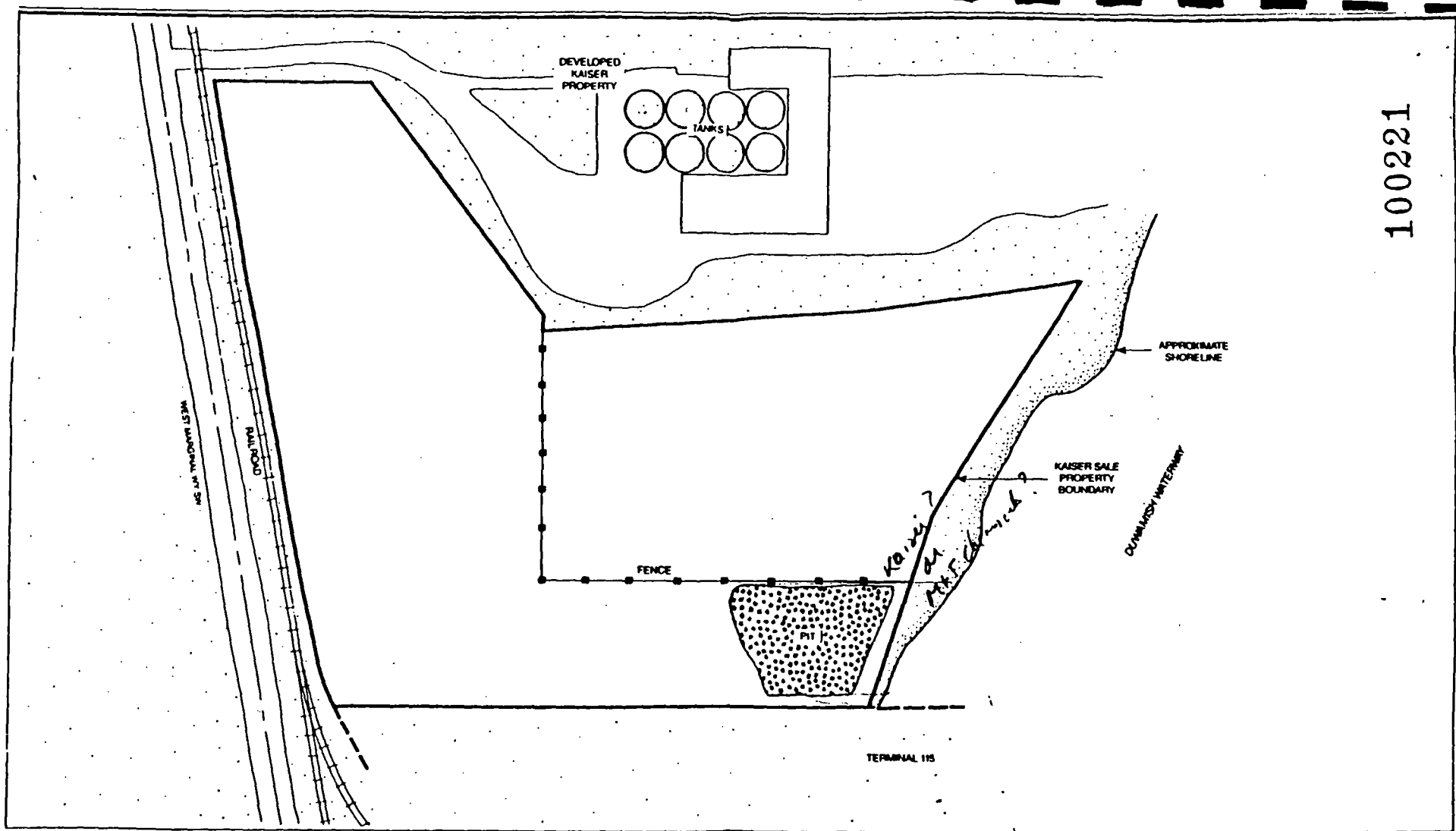


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Figure 5.
Development of Kaiser Sale Property In 1974.

ascertain if unusual subsurface conditions or residues were encountered during drilling operations. No unusual conditions or residues other than the overlying fill soil were reported. The approximate location of borings and probes are shown in Figure 6. Borings H-1 through H-5 (ranging in depth from 39 to 89 feet) show fill underlain by alluvium and clayey silt. A water table aquifer is encountered at a depth of 5 to 7 feet below grade. The Hart-Crowser report does indicate, however, that an area of relatively low resistivity is located in the southeast corner of the sale property. This may correspond to leaching from the Kaiser disposal pit.

Immediately south of the property, the Port has leased the northern most part of Terminal 115 to MRI Corporation (MRI). The MRI facility is apparent on the 1969 and 1974 aerial photographs. We understand that MRI is a metal reclamation and plating firm. The 1969 aerial photograph clearly shows two evaporation/infiltration impoundments which were reportedly used for plating waste effluent disposal. By 1974, the ponds had been closed. A Preliminary Assessment (PA) of the MRI property as a Potential Hazardous Waste Site was prepared in November, 1984 for the state of Washington. This PA assigned a medium priority to the site contamination by heavy metals. We did no see any indication that MRI discharged or disposed of any materials directly to the Kaiser sale property, but there is a potential for transport of contaminants from MRI to the Kaiser property via groundwater.

III. FIELD INVESTIGATION

Health and Safety Considerations

The field investigation was completed in accordance with our internal health and safety program. PMX site personnel are current in their medical monitoring program and have received the equivalent of the EPA Hazardous Waste Site Investigation Course. Drilling personnel were also trained for hazardous waste site investigations. A health and safety program specific to the conditions expected and possible at the site was prepared and then followed during the investigation. The basic level of protection consisted of disposable protective clothing, protective gloves, safety boots, hard hat and eye protection. The program called for continuous monitoring of organic vapors. Vapor levels were monitored by a flame ionization detector (Organic Vapor Analyzer) within the breathing environment. The program called for the following action dependent upon vapor level readings:

5 to 50 ppm - use of half-face cartridge respirator with acid gas and organic vapor cartridge.

>50 ppm - cease all work and leave work area until vapor levels subside.

Much of the investigation was conducted using half-face respirators since varying levels of vapor concentrations were encountered during the course of the drilling program. When high concentrations of organic vapors were detected we also checked the gas for explosive concentrations using a combustible gas indicator. If explosive gas is detected above the lower explosive limit (as methane) then all work was to cease immediately.

Monitoring Instruments

A flame ionization detector was used both for health and safety monitoring as described above and to characterize vapors in the borings during sampling activities. The detector used was an Organic Vapor Analyzer (OVA). The OVA is a portable flame ionization unit. A continuous stream of air is drawn into the instrument by an enclosed pump. This sample is exposed to a hydrogen flame which ionizes organic molecules. Positive ions are collected on an electrode and pass a current proportional to the concentration of the molecule in the air. This information is displayed on an instrument dial held by the operator.

The OVA responds to many organic vapors. The instrument is calibrated with a known concentration of a hydrocarbon gas at the time of manufacture. The OVA is sensitive to 0.1 ppm of methane and has an upper limit on the scale of 1000 ppm (.01%). The OVA as used in the survey mode cannot identify a specific organic compound. It is also not able to detect inorganic vapors.

The combustible gas indicator is designed to detect flammable gas. The instrument operates by catalytically oxidizing flammable gas with a platinum filament. The heat produced by this reaction changes the resistivity of the wire. A wheatstone bridge is used to produce a deflection on the meter corresponding to the concentration of the gas. This meter only detects flammable gas. Its scale reads from zero to 5 percent total concentration with a level of detection at about 0.2% which corresponds to about 20,000 ppm. The instrument is not sensitive to very low concentration of gas as is the OVA.

Soil Sampling

Our field investigation consisted of sampling and characterization of soils and monitoring of vapors released or generated by the drilling operation. Soil sampling locations were selected based upon the results of the site history study. As a

result of that study several areas of potential concern were identified. Boring locations are identified on Figure 7. The borings were located in the field by pacing and are therefore approximate as shown. The areas of concern and borings advanced in those areas are described below:

BORINGS	AREA
3-8	Pit or Impoundment operated by Reichhold Chemical
1,2,13-15	Truck washout area operated by Kaiser Cement
22-29	Tank farm operated by Reichhold Chemical
All others	No specific concerns

All borings were advanced using a truck mounted Mobil B-61 drill rig with hollow stem auger. Borings 3 and 28 were advanced to a total depth of 15 feet. All other borings were advanced to a depth of five feet. Soil samples were taken at two and one-half foot intervals using a split spoon sampler. The sampler was washed and double rinsed with clean water between sampling intervals. All samples were described in the field and then immediately placed into containers provided by the laboratory. Filled sample containers were immediately placed in cool storage for shipment to the laboratory. Chain-of-custody procedures were also observed. Chain-of-custody forms are included in Appendix A.

Each sample was tested for soil pH in the field. A split of each sample was prepared as a slurry of approximately 3 parts distilled water to one part soil. This slurry was tested for pH using a digital pH meter. The results of the soil pH measurements are shown on Table 1. OVA readings were taken inside the hollow stem auger immediately after sample withdrawal. OVA readings were also taken inside the open borehole immediately after auger withdrawal. These observations are also shown on Table 1.

SUBSURFACE CONDITIONS

Soil conditions encountered were very uniform across the site. Generally, soils encountered consisted of six to eighteen inches of sandy gravel fill overlying grey to black sand which was occasionally silty. In several borings a thin layer of yellow to orange sawdust was encountered immediately beneath the fill. Both of the deeper borings encountered a silty soil at a depth of about 10 feet but at fifteen feet both borings were into a dark sand unit similar to that encountered at a shallower

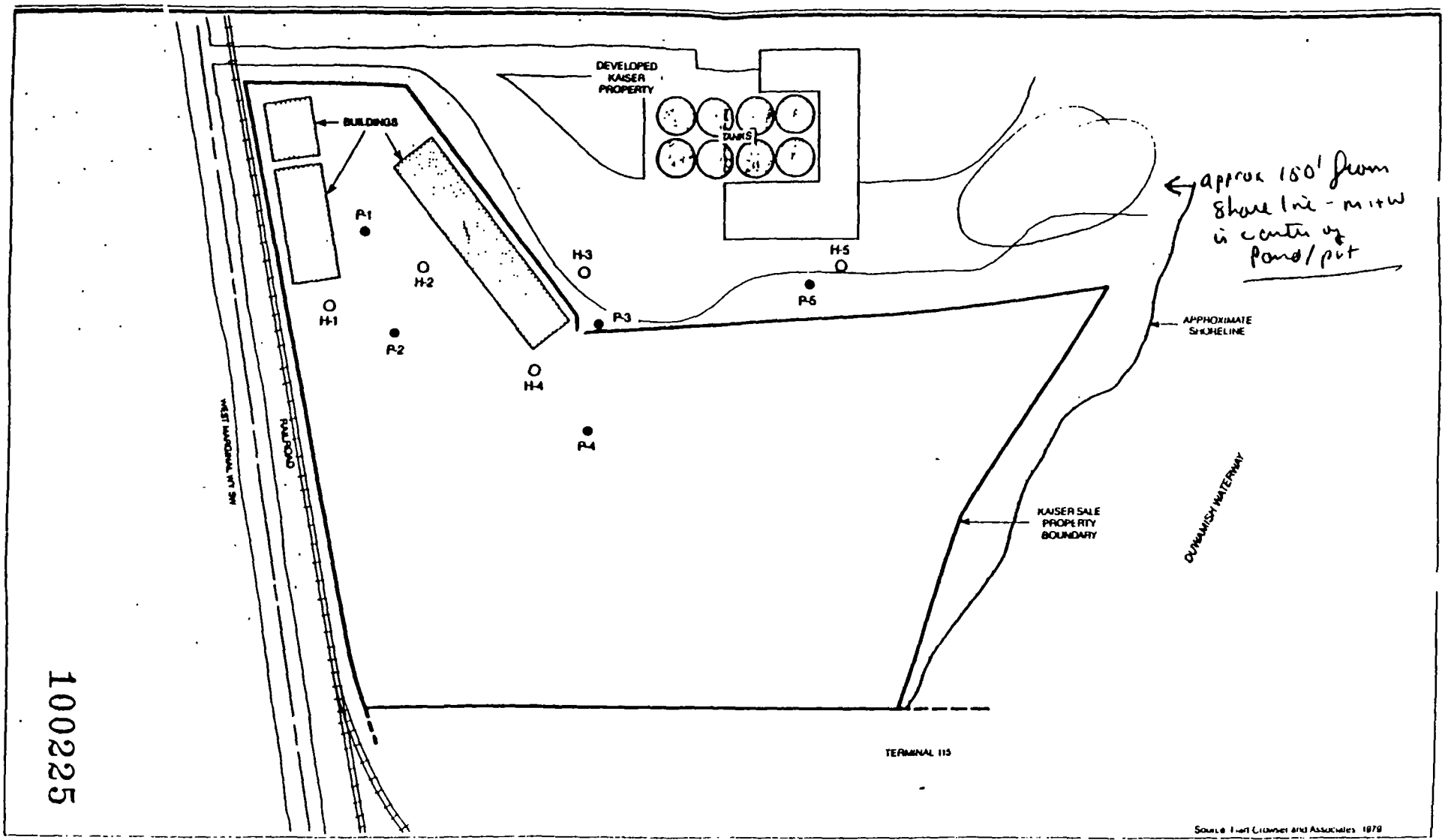

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Figure 6.
Approximate locations of Dutch Cone Penetrometer probes and soil borings conducted by Hart-Crowser and Associates in 1979.

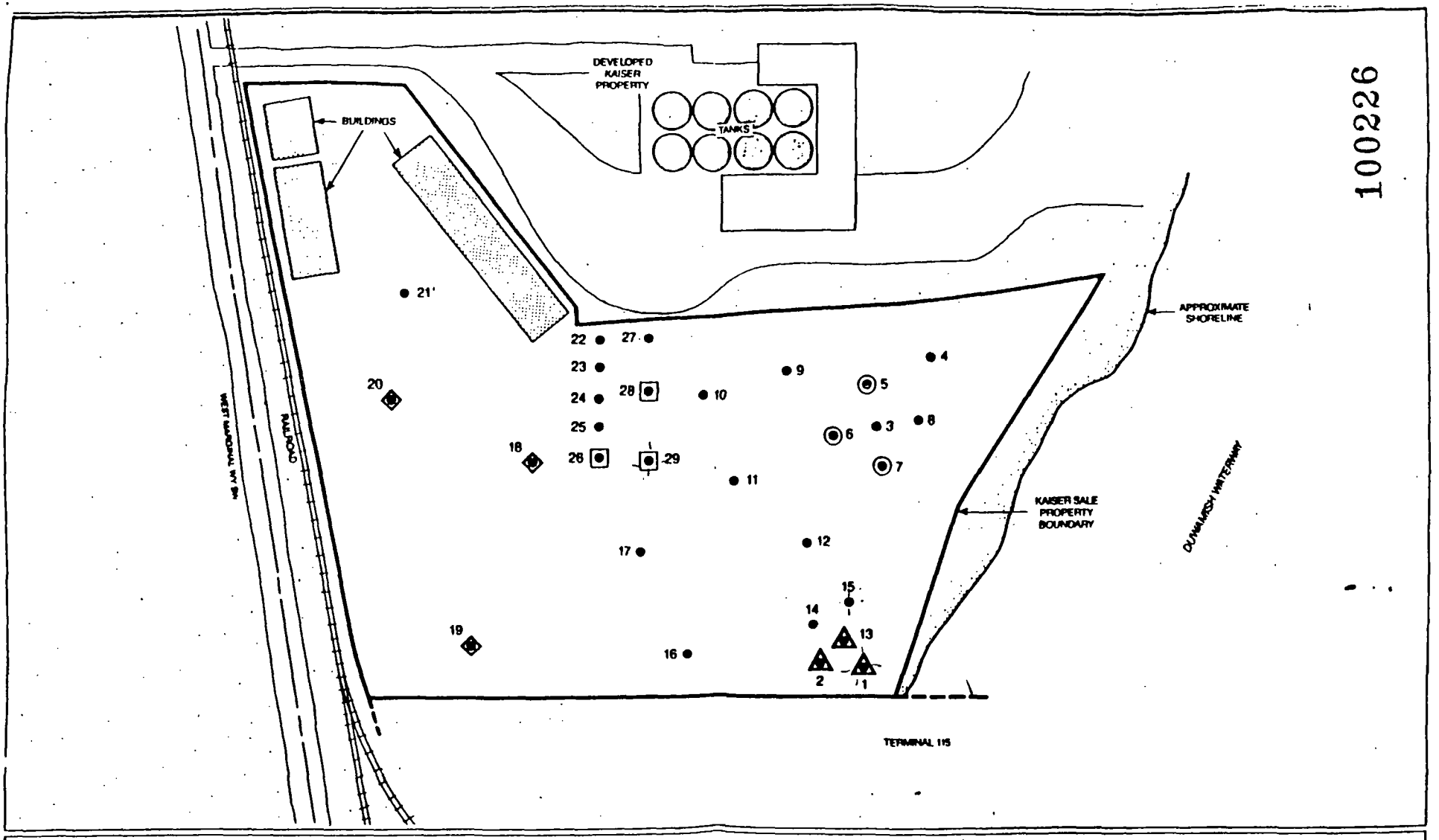

Figure 7.
Locations of Borings and Sources of Composite Samples
Kaiser Property, Seattle, Washington

Parametrix, Inc.

TABLE 1

SUMMARY OF FIELD OBSERVATIONS

BORING & SAMPLE #	DEPTH	DESCRIPTION	BORING OVA	SOIL pH	SAMPLE OVA*
1-1	0.0	Orange Sawdust	>1000	8.2	>1000
1-2	2.5	Grey Sand		8.0	50
1-3	5.0	Grey Sand		7.4	>1000
2-1	2.5	Grey Sand	>1000	7.4	>1000
2-2	5.0	Grey Sand & Silty Fine Sand		7.2	>1000
3-1	2.5	Black Sand	>1000	6.3	10
3-2	5.0	Black Sand		6.1	10
3-3	7.5	Black Sand		6.3	50
3-4A	10.0	Black Sand		6.4	100
3-4B	10.5	Grey Silt		7.0	100
3-5	12.5	Silt & Silty Fine Sand w/organics		7.0	10
3-6	15.0	Black Medium Sand		6.3	14
4-1	2.5	Black Sand	>1000	9.7	0
4-2	5.0	Black Sand, wet		9.0	15
5-1	2.5	Black Sand	>1000	5.3	>1000
5-2	5.0	Black Sand		5.4	>1000
6-1	2.5	Black Sand	100	5.7	60
6-2	5.0	Black Sand		5.6	38
7-1	2.5	Brown Sand	200	5.3	4
7-2	5.0	Grey Sand		5.5	6
8-1	2.5	Black Sand	>1000	8.2	9
8-2	5.0	Black Sand, wet		6.4	6
9-1	2.5	Black Sand	10	6.8	9
9-2	5.0	Black Sand		6.1	160
10-1	2.5	Brown & Grey Sandy Silt & Sand	80	7.8	2
10-2	5.0	Grey Sand		-------	100
11-1	2.5	Grey Sand	250	7.6	>1000
11-2	5.0	Grey Silty Sand		7.5	>1000
12-1	2.5	Black Fine Sand w/ fine carbon	100	5.8	200
12-2	5.0	Black Medium Sand		5.9	50
13-1	1.0	Fine Carbon with Sand	>1000	6.3	-------
13-2	2.5	Black Sand		6.2	>1000
14-1	2.5	Grey Sand	------	7.3	450
14-2	5.0	Grey Sand and Silty Fine Sand		6.8	>1000
15-1	1.0	Sawdust	>1000	5.9	100
15-2	2.5	Black Sand		6.2	40
15-3	5.0	Silty Fine Sand		6.8	200

* OVA reading in auger after sample was taken

TABLE 1 (continued)

SUMMARY OF FIELD OBSERVATIONS

BORING & SAMPLE #	DEPTH	DESCRIPTION	BORING OVA	SOIL pH	SAMPLE OVA*
16-1	2.5	Brown Sand	------	7.6	350
16-2	5.0	Grey Sand & Grey Silt		-------	>1000
17-1	2.5	Brown Sand	>1000	7.6	230
17-2	5.0	Black Sand & Black Silt w/organics		8.2	>1000
18-1	2.5	Brown Sand	30	7.6	6
18-2	5.0	No Recovery		-------	7
19-1	2.5	Brown Fine Sand	50	7.8	2
19-2	5.0	Grey Sand		7.7	10
20-1	2.5	Grey Fine Sandy Silt w/organics	7	8.1	0
20-2	5.0	Grey Sand		7.3	3
21-1	2.5	Grey Sand	------	7.9	20
21-2	5.0	Grey Sand		7.5	600
22-1	2.5	Grey Silty Sand	9	6.6	9
22-2	5.0	Grey Sand		6.5	0
23-1	2.5	Black Sand w/ carbon	30	6.2	0
24-1	2.5	Black Sand	------	6.4	0
24-2	5.0	Black Sand		6.4	280
25-1	2.5	Dark Grey Silty Sand	60	6.5	2
26-1	2.5	Dark Grey Silty Sand	600	6.6	600
26-2	5.0	Dark Grey Sand		6.3	>1000
27-1	2.5	Grey Sand	0	6.8	0
27-2	5.0	Grey Sand		6.8	0
28-1	2.5	Fine Sandy Silt	>1000	7.0	0
28-2	5.0	Black Sand & Silty Sand		6.7	600
28-3	7.5	Black Sand		7.2	15
28-4	10.0	Brown Silt w/organics		7.9	10
28-5	12.5	Grey Sand		7.2	80
28-6	15.0	Grey Sandy Silt w/organics		8.0	660
29-1	2.5	Orange Sawdust	>1000	8.2	210
29-2	5.0	Yellow Sawdust and Black Sand		7.6	>1000

* OVA reading in auger after sample was taken

depth. These sediments are very typical of those found in the Duwamish River valley. It is often very difficult to differentiate between natural soils and old dredge spoils from the Duwamish River placed on adjacent shore areas. Aerial photography, Figures 2 and 3, indicates that the site is on the original shoreline of the Duwamish River and no evidence of widespread fill is apparent on the site.

Groundwater was encountered in several borings at a depth of about five to six and one-half feet below the ground surface. Because of the nature of the exploration (depth and method of sampling) the groundwater levels were not always apparent in all borings. No groundwater monitoring wells were installed nor were any groundwater samples obtained.

IV. CHEMICAL ANALYSES

A total of four composite samples were made from 24 of the samples collected from 12 of the borings. The selection of samples making up each composite sample was based upon a review of the field observations with Port personnel. A summary of the composite samples is presented in Table 2. The source locations for each composite sample are also shown on Figure 7.

Compositing and laboratory analyses were performed by Analytical Technologies, Inc. All four composite samples were tested for priority pollutants. A list of those parameters analyzed for is presented in Appendix B.

The results of the laboratory analyses are included as Appendix C of this report. Table 3 summarizes those components which were reported at levels above the detection limit.

V. DISCUSSION

Very little visual evidence was observed indicative of the level of past activity suspected at the site. Sawdust was encountered at a shallow depth in four of the five borings advanced in the vicinity of the former Kaiser Cement wash-out pond. Black, fine carbon-like material was encountered mixed with sand in three borings (12,13 and 23).

OVA readings were very high in borings all over the site. The highest OVA readings were found in the eastern half of the site where most of the investigation was concentrated. The laboratory analysis did not identify the source of the readings on the OVA, in fact, no volatile organics were detected by the laboratory analyses. It is suspected that whatever was causing the readings on the OVA was not within the suite of parameters (priority pollutants) analyzed for. The most probable candidate

TABLE 2

SUMMARY OF COMPOSITE SAMPLES

COMPOSITE	BORING & SAMPLE #	DEPTH	BORING OVA	SOIL pH	SAMPLE OVA*
ONE	5-1	2.5	>1000	5.3	>1000
	5-2	5.0		5.4	>1000
	6-1	2.5	100	5.7	60
	6-2	5.0		5.6	38
	7-1	2.5	200	5.3	4
	7-2	5.0		5.5	6
TWO	1-1	0.0	>1000	8.2	>1000
	1-2	2.5		8.0	50
	1-3	5.0		7.4	>1000
	2-1	2.5	>1000	7.4	>1000
	2-2	5.0		7.2	>1000
	13-1	1.0	>1000	6.3	-------
	13-2	2.5		6.2	>1000
THREE	26-1	2.5	600	6.6	600
	26-2	5.0		6.3	>1000
	28-1	2.5	>1000	7.0	0
	28-2	5.0		6.7	600
	29-1	2.5	>1000	8.2	210
	29-2	5.0		7.6	>1000
FOUR	18-1	2.5	30	7.6	6
	19-1	2.5	50	7.8	2
	19-2	5.0		7.7	10
	20-1	2.5	7	8.1	0
	20-2	5.0		7.3	3

* OVA reading in auger after sample withdrawal

TABLE 3

SUMMARY OF DETECTABLE COMPONENTS FROM LABORATORY ANALYSIS

PARAMETER	UNITS	COMPOSITE NUMBER 1	2	3	4
PRIORITY POLLUTANT METALS					
Arsenic	mg/kg	51.0	26.0	46.0	20.0
Chromium	mg/kg	5.8	8.3	7.3	6.4
Copper	mg/kg	17.1	5.9	24.1	4.4
Lead	mg/kg	<2.5	2.5	<2.5	<2.5
Nickel	mg/kg	3.8	3.7	11.4	5.3
Mercury	mg/kg	<0.10	<0.10	<0.10	0.2
Zinc	mg/kg	27.6	18.7	40.3	17.0
Fluoride	mg/kg	116.0	92.0	84.0	98.0
SEMI-VOLATILE ORGANIC COMPOUNDS					
Di-n-butyl Phthalate	mg/kg	0.93	0.33	<0.08	0.43
Bis (2-ethylhexyl) phthalate	mg/kg	0.13	1.3	<0.08	<0.08
VOLATILE ORGANIC COMPOUNDS		None detected			
PESTICIDES & PCB's					
Aldrin	ug/kg	<2.0	<2.0	5.4	<2.0
Alpha - BHC	ug/kg	2.4	<1.5	3.4	<1.5
Dieldrin	ug/kg	<1.0	<1.0	<1.0	2.6

100231

is methane. The combustible gas indicator was used occasionally to verify that an explosive atmosphere was not present in the work environment. This instrument only registered the presence of combustible gas once, in boring 2, where a visible vapor density current was observed exiting the top of the hollow stem auger after a layer of orange sawdust had been penetrated. In that case the instrument registered a level of about 0.5% (50,000 ppm) explosive vapors in the gas exiting the auger. Since the upper level of detection for the OVA is 1000 ppm and the lower level of detection for the explosive gas indicator is about 20,000 ppm there is a range of 1000 to 20,000 ppm in which no readings would be available.

Based upon the readings obtained by field instrumentation and laboratory analyses, we expect that the organic vapors indicated in the field are probably methane gas cause by the decomposition of the sawdust under the fill soil. Low concentrations of this gas may be migrating laterally beneath the fill soil thus resulting in high OVA readings in areas where no sawdust was encountered. The gas generated by the decomposition of sawdust is a mixture of methane and carbon dioxide. Depending upon the relative concentrations of the two gasses it may be lighter or heavier than air. If the gas is heavier than air that would more readily explain lateral migration of the gas through the upper soil layers. It is also possible that the gas causing the high OVA readings is an unidentified gas which is undetectable using a standard priority pollutant scan.

The results of the laboratory analyses were not conclusive. A review of those components detected as shown on Table 3 does not indicate that any of the four areas represented by the composites is significantly contaminated. The levels of metals reported are total metals and do not necessarily represent leachable concentrations of metals.

VI. HAZARD ASSESSMENT

If the gas detected by the OVA is a mixture of methane and carbon dioxide as is suspected, then there are no known acute or chronic toxic effects caused by breathing the gas. Breathing in an atmosphere containing this gas can result in asphyxiation due to oxygen depletion. Workers excavating in such soils should have combustible gas monitors available to warn of high concentrations of methane gas. Any excavations should be open, with broad side slopes to allow adequate ventilation. If the weather is particularly hot and/or there is little wind, artificial ventilation should be considered. At all times when working in such environments care should be taken to avoid open flames or sparks. All equipment should be equipped with non-sparking apparatus.

Measures should be taken to avoid breathing dust generated during any excavation activities. Although the levels of metals indicated are too low to cause a health problem under normal operating conditions, certain areas with significantly elevated concentrations may exist on the site. Precautions may include the use of particulate respirators or the wetting of soils to inhibit dust production.

Standard precautionary hygiene is also advised including no eating or smoking on the job site, washing hands before eating and washing off boots before leaving the site.

Although no E.P. Toxicity tests were performed on the soils to determine if they would be classified as a dangerous waste according to WAC 173-303, it is not expected that the soils on the site would be classified as such. The composite samples of soil tested would be accepted for disposal at a solid waste landfill. If soils excavated from the site are being considered for export as fill material we would recommend further testing of the soil contingent upon their intended use. There may be discreet zones or pockets of potentially hazardous contaminated sediments at the site that were not identified during our field investigation.